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CONIFERS

ILLUSTRATIONS OF CONIFERS.

BY
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ILLUSTRATIONS

OF

CONIFERS

By H. CLINTON-BAKER.

VOLUME II.

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ILLUSTRATIONS

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BY H. CLINTON BAKER.

VOLUME II.

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A B I E S.

EVERGREEN trees belonging to the Coniferæ, with tall straight trunks regularly whorled with branches. Buds at the ends of the shoots either resinous or non-resinous. Leaves persistent for many years, variously arranged on the branchlets; on lateral shoots pectinate, radially arranged or crowded and directed forwards in imbricated ranks. On leading shoots the leaves are radially arranged and on cone-bearing branches they are directed upwards.

Leaves linear, flattened or quadrangular in section, upper surface green, with or without stomata; lower surface with two white or greyish bands of stomata; apex rounded, single-pointed or notched.

Flowers monœcious. Cones ripening in one year, erect on the branchlets, composed of thin woody scales, longer or shorter than the bracts; seeds two on each scale, winged and provided with resin vesicles. The cone on maturity falls to pieces, the scales, bracts and seeds separating from the central spindle-like axis.

Abies are easily distinguished from all other conifers by the circular base of the leaves, which, on falling or when pulled off show a circular scar on the branchlet.

About 80 species of Abies have been described, natives of the temperate regions and with a few exceptions confined to mountainous districts.

KEY TO ABIES.

This key is based upon characters taken from the foliage, buds and shoots of lateral branches on the lower part of the tree.

I.—LEAVES RADIALY ARRANGED ON THE BRANCHLETS; APEX OF THE LEAF NOT BIFID.

- A. Pinsapo*, Boissier; Spain. Leaves rigid, short, less than $\frac{3}{4}$ inch long, thick, with lines of stomata on each surface, acute at the apex; resin canals median. Shoots glabrous. Buds resinous.
- A. cephalonica*, Loudon; Greece. Leaves thin, flattened, about 1 inch long, white with stomata beneath, ending in a sharp cartilaginous point; resin-canals marginal. Shoots glabrous. Buds resinous.

II.—LEAVES ON THE LATERAL BRANCHES PECTINATE IN ARRANGEMENT; THE TWO LATERAL SETS EITHER IN THE HORIZONTAL PLANE OR WITH THEIR UPPER RANKS DIRECTED UPWARDS AS WELL AS OUTWARDS SHOWING A V-SHAPED DEPRESSION, AS SEEN FROM ABOVE, BETWEEN THE TWO SETS.

*Resin-canals marginal.*¹

- A. bracteata*, Nuttall; California. Leaves long, 2 inches or more, rigid, white with stomata beneath, ending in a spine-like point. Shoots glabrous. Buds large, elongated, fusiform, membranous, non-resinous.
- A. grandis*, Lindley; western N. America. Leaves all in the horizontal plane, those in the upper rank about half the length of those below, up to 2 inches long, bifid at the apex; upper surface grooved; lower surface with bands of stomata. Shoots minutely pubescent. Buds small, resinous.
- A. Lowiana*, Murray; California. Leaves in a V-shaped arrangement, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, bifid at the apex; upper surface grooved and with stomata; lower surface with white lines of stomata. Shoots and buds as in *A. grandis*.
- A. firma*, Siebold and Zuccarini; Japan. Leaves in a V-shaped arrangement, rigid, very coriaceous, broad, up to $1\frac{1}{2}$ inch long, with broad lines of stomata on lower surface, ending in two sharp cartilaginous points. Shoots pubescent in the furrows between the slightly raised pulvini. Buds small, ovoid, slightly resinous.
- A. pectinata*, De Candolle; Europe. Leaves pectinate in one plane or tending to a V-shaped arrangement, about an inch long, with white lines of stomata beneath, slightly bifid at the apex. Shoot grey with short pubescence. Buds ovoid, non-resinous.
- A. Webbiana*, Lindley; Himalayas. Leaves V-shaped in arrangement, up to $2\frac{1}{2}$ inches long, bifid, silvery white beneath. Shoots with prominent pulvini and deep grooves, with a reddish pubescence confined to the grooves. Buds large, globose, resinous.

Resin-canals median.

- A. balsamea*, Miller; eastern N. America. Leaves slender, scarcely 1 inch long, bifid at the apex, with grey lines of stomata beneath. Shoots smooth, grey, with scattered, short erect pubescence. Buds globose, resinous.
- A. Fraseri*, Poiret; Alleghany Mountains. Leaves as in *A. balsamea*, but shorter and whiter beneath. Shoots smooth, yellowish, with dense, reddish, curved or twisted pubescence. Buds globose, resinous.
- A. brachyphylla*, Maximowicz; Japan. Leaves in a V-shaped arrangement, short, scarcely exceeding $\frac{7}{8}$ inch, slightly bifid, white beneath. Shoots glabrous, with prominent pulvini and deep grooves. Buds conical, resinous.

¹*A. cilicica* and *A. numidica* with weak shoots, come in this section.

III.—LEAVES ON LATERAL BRANCHES NOT PECTINATE ABOVE, BUT DENSELY CROWDED, THOSE IN THE MIDDLE LINE DIRECTED FORWARDS IN IMBRICATED RANKS, THEIR BASES NOT BEING APPRESSED TO THE BRANCHLET. ON THE LOWER SIDE OF THE SHOOT THE LEAVES ARE IN TWO LATERAL SETS.

*Resin-canals marginal.*¹

- A. *Nordmanniana*, Spach²; Caucasus. Leaves up to 1½ inch long, with white lines of stomata beneath, with rounded bifid apex. Shoots smooth, with short scattered erect pubescence. Buds ovoid, brown, non-resinous.
- ← A. *amabilis*, Forbes; western N. America. Leaves in arrangement and size like those of *A. Nordmanniana*, but much darker shining green and with a truncate bifid apex, with white bands of stomata beneath; they emit a fragrant odour when bruised. Shoots smooth, with short wavy pubescence. Buds small, globose, resinous.
- A. *religiosa*, Schlechtendal; Mexico, Guatemala. Leaves about 1 inch long, with whitish lines of stomata beneath, gradually narrowing from the middle to the usually entire apex which is occasionally slightly emarginate. Shoots with prominent pulvini and dense minute erect pubescence. Buds shortly cylindrical, resinous. The median upper leaves are much less numerous than in the two preceding species.
- A. *Mariesii*, Masters; Japan, Formosa. Leaves shorter and broader than in *A. Veitchii*, with white bands of stomata beneath, widest in their upper third, with a rounded and bifid apex. Shoot densely covered with a ferruginous pubescence. Buds small, globose, resinous.

Resin-canal median.

- A. *Veitchii*, Lindley; Japan. Leaves up to 1 inch long, truncate and bifid at the apex, uniform in width, silvery white beneath. Shoots smooth, covered with dense short erect pubescence. Buds small, globose, resinous. The upper median leaves point forwards and stand off from the shoot at a wider angle than in *A. Nordmanniana*.
- A. *sachalinensis*, Masters; Saghalien, Yezo, Kurile Isles. Leaves long and slender, up to 1½ inch, uniform in width, with a rounded and bifid apex, silvery-white beneath. Shoots with prominent pulvini, and a dense, short pubescence confined to the grooves. Buds small, globose, resinous.
- A. *sibirica*, Ledebour; N.E. Russia, Siberia, Turkestan. Leaves long and slender, up to 1½ inch, with narrow white bands of stomata beneath, uniform in width; apex rounded and either slightly bifid or entire. Shoots ashy grey, quite smooth, with a scattered minute pubescence. Buds small, globose, resinous.

IV.—LEAVES ON LATERAL BRANCHES NOT PECTINATE ABOVE; THOSE IN THE MIDDLE LINE COVERING THE BRANCHLET, AND CURVING UPWARDS AFTER BEING APPRESSED TO THE SHOOT FOR SOME DISTANCE AT THEIR BASE. THE LEAVES ARE IN TWO LATERAL SETS ON THE LOWER SIDE OF THE BRANCHLET. RESIN-CANALS MARGINAL.

- A. *nobilis*, Lindley; Washington, Oregon, California. Leaves above closely appressed by their bases to the branchlet which they completely conceal; about 1 inch long, entire at the apex, flattened, grooved on the upper surface in the middle line; stomata usually present on both surfaces. Shoots with a dense, short, brown pubescence. Terminal buds girt at the base by a ring of acute or subulately-pointed pubescent scales.
- A. *magnifica*, Murray; Oregon, California. Leaves above appressed at their bases for a short distance only to the branchlet, which they do not completely conceal; longer than in *A. nobilis*, up to 1½ inch, entire at the apex, quadrangular in section, not grooved on the upper surface; stomata always present on both surfaces. Shoots and buds as in *A. nobilis*.

¹*A. numidica* with strong shoots is distinguished from all these species by the leaves of the upper side being directed backwards.

²*A. cilicica*, with strong shoots, resembles a weak *A. Nordmanniana*.

V.—LEAVES ON LATERAL BRANCHES ARRANGED IN TWO WAYS WHICH ARE OFTEN OBSERVABLE ON THE SAME TREE AND DEPEND UPON THE VIGOUR OF THE SHOOTS.

- A. cilicica*, Carrière; Asia Minor. Leaves either (A) pectinate above with a V-shaped depression between the lateral sets, or (B) with the median leaves above crowded and covering the branchlet, as in *A. Nordmanniana*. The leaves are slender, up to $1\frac{1}{4}$ inch long, not conspicuously white below, slightly bifid at the rounded or acute apex; resin-canals marginal. Shoots smooth, with scattered short erect pubescence. Buds small, ovoid, non-resinous. Vigorous shoots of this species resemble a weak *A. Nordmanniana* but with the leaves shorter, more slender and less white beneath. The buds are much smaller.
- A. numidica*, De Lannoy; Algeria. Leaves either pectinate above with a V-shaped depression, or crowded and covering the upper side of the branchlet, but different from all other species in the median leaves above, in that case being directed backwards and not forwards. Leaves short, up to $\frac{3}{4}$ inch long, broad, rounded at the entire or slightly bifid apex; in most cases with four to six broken lines of stomata on their upper surface near the tip, lower surface with white lines of stomata; resin-canals marginal. Shoots brown, shining, glabrous. Buds large, ovoid, non-resinous.

VI.—LEAVES IRREGULARLY ARRANGED; THOSE ON THE LOWER SIDE OF THE BRANCHES NOT TRULY PECTINATE.

- A. Pindrow*, Spach; W. Himalayas. Leaves all directed more or less forwards; those above irregularly and imperfectly covering the branchlet; those below mostly pectinate but with some directed downwards and forwards. Leaves soft, pale green, up to $2\frac{1}{2}$ inches long, lower surface with grey lines of stomata, bifid at the apex with two sharp cartilaginous points; resin-canals marginal. Shoots grey, glabrous. Buds large, globose, resinous.
- A. concolor*, Lindley and Gordon; Colorado, Utah, Arizona. New Mexico, Northern Mexico, Southern California. Leaves imperfectly pectinate both above and below, some in the middle line being always directed forwards and not laterally outwards; up to 2 to 3 inches long; apex entire; upper surface convex and not grooved, with lines of stomata; resin-canals marginal. Shoots smooth, olive-green, glabrous. Buds large, conical, resinous.
- A. lasiocarpa*, Nuttall; western N. America. Leaves either in an imperfectly pectinate arrangement or with most of the leaves directed upwards, those in the middle line above crowded and standing edgewise; $1\frac{1}{2}$ inches long, narrow, usually entire, with conspicuous lines of stomata on the upper surface, especially in their anterior half. Resin-canals median. Shoots smooth, with a moderately dense, short, wavy pubescence. Buds small, conical, resinous.





ABIES AMABILIS.



ABIES AMABILIS.

ABIES AMABILIS (*Forbes*).

Gardeners' Chronicle, Vol. XIV. p. 720 (1880) with figs.

" " Vol. III. new series, p. 754 (1888) with fig.

Veitch's Man. Conif. ed. 2, p. 489 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 782 (1909).

A TREE attaining in America a height of 200 feet. Bark in young trees thin, pale and smooth, covered with blisters containing aromatic resin, becoming thick, fissured and scaly in older specimens. Branchlets grey and covered with a loose pubescence. Buds small and globose, encrusted with resin.

Leaves persistent 8-10 years, spirally crowded, those on the lower side of the branchlets pectinate; those on the upper side more or less appressed to the shoot and pointing forward, linear, flattened, more or less curved, $1\frac{1}{4}$ to $1\frac{1}{2}$ inch long by one-fourteenth inch broad, with a truncate and bifid apex. Upper surface dark green and shining, lower surface with two broad white bands of stomata.

Cones ovoid-cylindric, slightly narrowed at the apex, dark purple at first but becoming brown when ripe, $3\frac{1}{2}$ -6 inches long by 2- $2\frac{1}{2}$ inches in diameter. Scales an inch or more wide and nearly as long as broad; bracts rhombic or obovate-oblong, shorter than the scale. Seed $\frac{1}{2}$ an inch long with a wing about $\frac{3}{4}$ inch in length.

A useful distinguishing character is afforded by the peculiar scent of the leaves when bruised, resembling that of a Tangerine orange.

This fir is a native of western North America, occurring on high mountain slopes and terraces, from British Columbia southward along the Cascade Mountains to northern Oregon and on the coast ranges of Oregon and Washington. The contrast of colour afforded by its whitish bark, dark green, glossy foliage and large purple cones make it a most handsome tree in its native habitats. It was discovered by Douglas on a mountain south of the Columbia River in 1825, and introduced into cultivation five years later.

Small trees are not infrequent in collections. The specimen at Bayfordbury is now 18 feet high; the date of planting is unknown. A young tree was added in 1906.

The illustration is a reproduction of a photograph kindly lent by Mr. G. B. Sudworth of Washington.

ABIES BALSAMEA (*Miller*). BALSAM FIR.

Gardeners' Chronicle, Vol. XVII. p. 422 (1895), with figs.

Veitch's Man. Conif. ed. 2. p. 492 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 808 (1909).

A TREE 50 - 60 feet high, or sometimes taller, with a trunk 3 - 5 feet in girth. Branches spreading, forming a pyramidal crown. Bark greyish-brown with numerous resin blisters, becoming scaly in old trees.

Buds small, globose, resinous. Branchlets smooth, grey, with short scattered pubescence, emitting a resinous odour when cut.

Leaves on lateral branches pectinate, the upper ones shorter than the lower and slightly ascending, forming a V-shaped depression, linear, flattened, rounded and slightly notched at the apex, about 1 inch long; upper surface dark green and shining, with interrupted lines of stomata towards the tip, lower surface with two bands of grey stomata.

Cones ovoid-cylindrical, purple, 2 - 4 inches long and about 1 inch in diameter; scales about five-eighths inch wide and long, bracts exserted or concealed. Seeds purplish, about $\frac{1}{2}$ inch long, with a wing about the same length.

The Balsam Fir occurs as a wild tree in Canada and the eastern United States, common on low ground but occasionally ascending to an altitude of 5,000 feet.

According to Loudon it was cultivated in England as long ago as 1697; it does not attain to any size and is not ornamental. The timber has little commercial value. The transparent resin known as Canada Balsam, obtained from the blisters on the bark is chiefly used in the preparation of microscopic objects.

The specimen planted at Bayfordbury in 1838 was killed in 1854: two young plants were added in 1907, one of which is now (1909) coning freely. Seedlings were raised the same year from American seed.

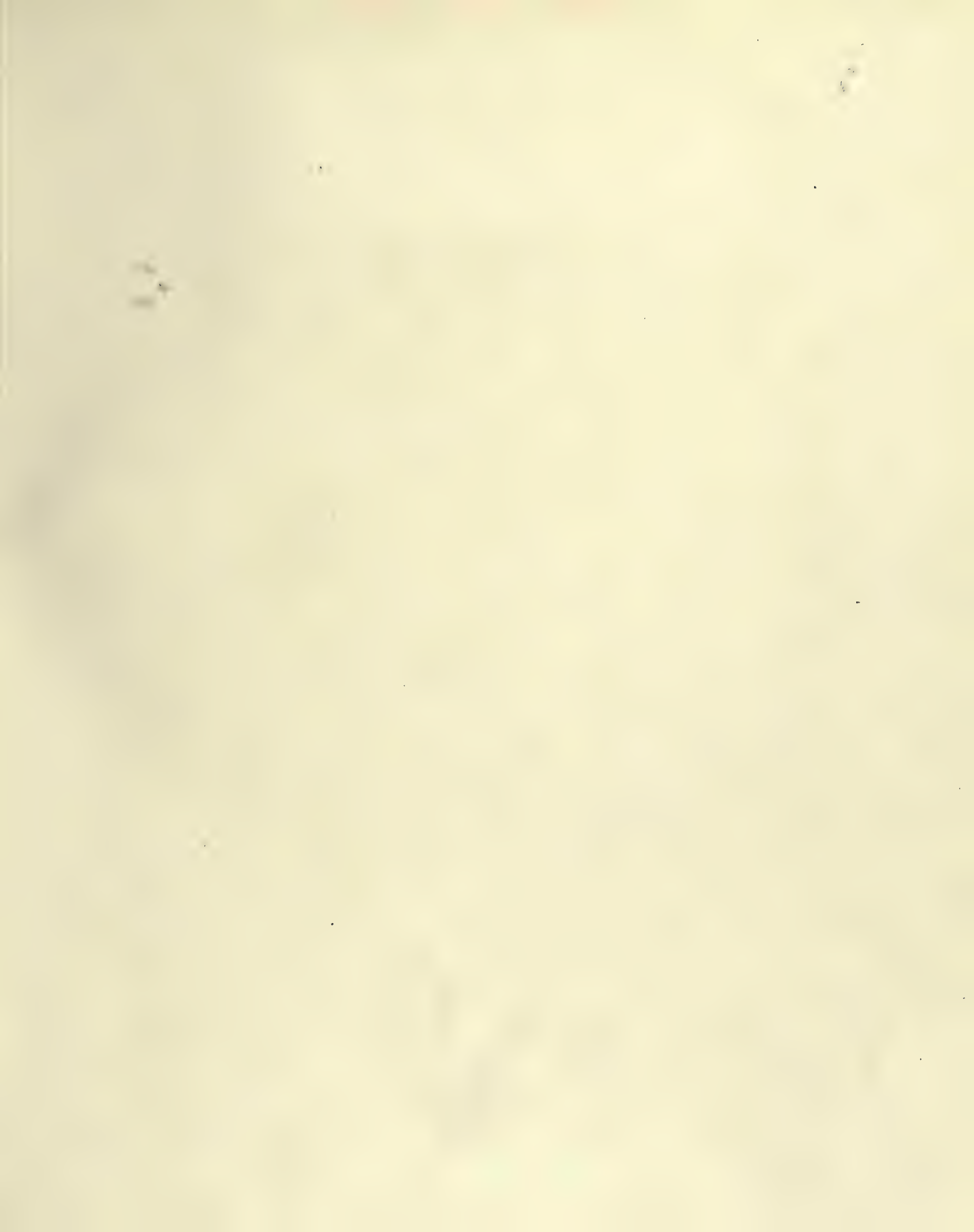
The illustration of cones is a reproduction of a plate in Professor Sargent's "Silva." The foliage is from a tree at Woburn Abbey.



ARIES BALSAMEA.

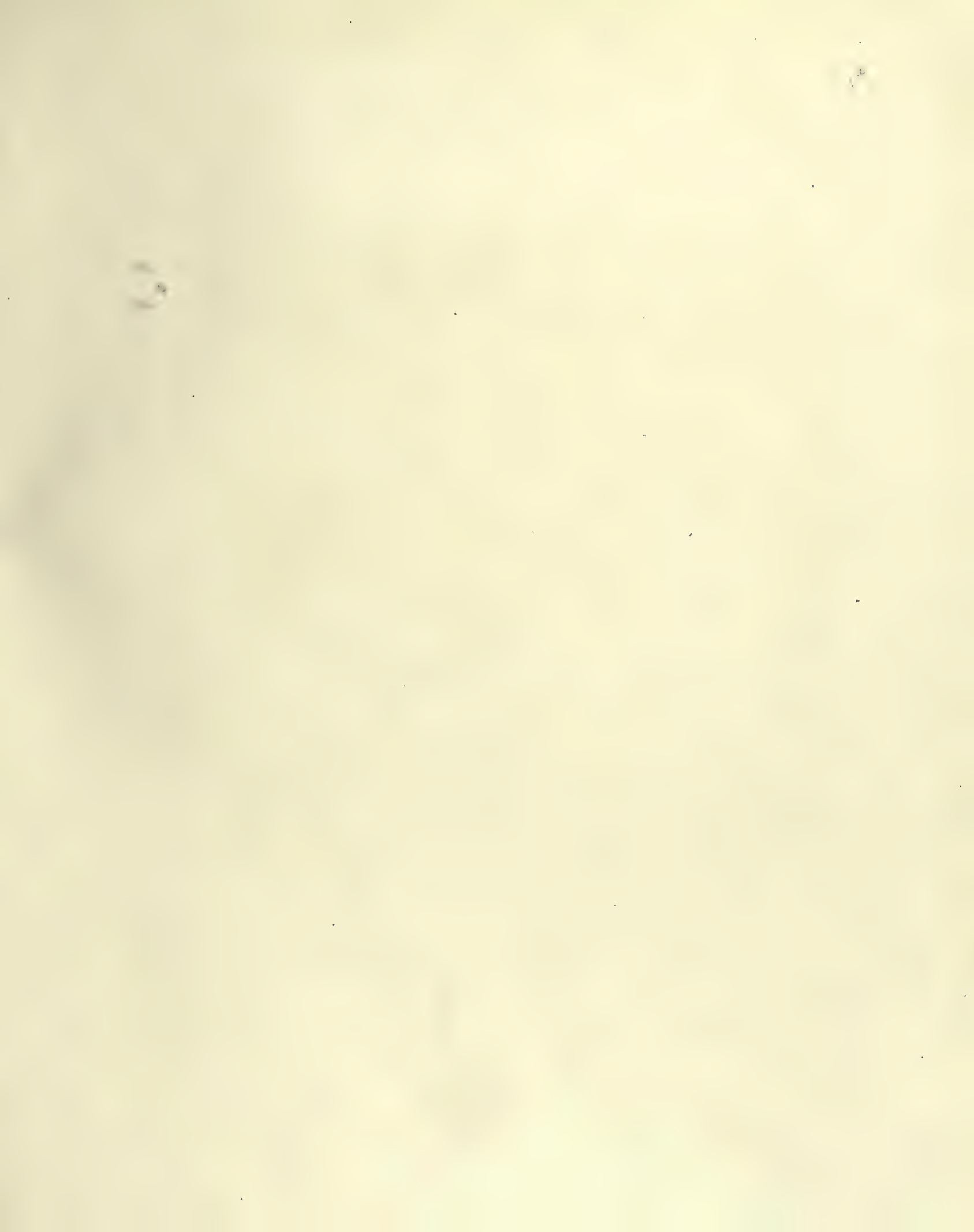


ABIES BALSAMEA.





ABIES BRACTEATA.





ABIES BRACTEATA.

ABIES BRACTEATA (*Nuttall*). BRISTLE-CONE FIR.

Gardeners' Chronicle, Vol. V. series 3, p. 242 (1889).

Veitch's Man. Conif. ed. 2, p. 493 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 796 (1909).

A TREE attaining a height of 100-150 feet with a trunk 1-3 feet in diameter. Bark greyish-brown, smooth. Branches short, pendulous and closely set, the lower ones often sweeping the ground and completely hiding the trunk, forming a tree with a pyramidal outline below and a narrow spire-like head.

Buds different in character from all the other species of *Abies*, spindle-shaped, $\frac{3}{4}$ inch long, non-resinous, composed of loose, light brown membranous scales. Leaves often 2 inches long, linear and rigid with long stiff cartilaginous points, white with stomata beneath. Cones 3-4 inches long by $1\frac{1}{2}$ -2 inches broad, remarkable for the long spine-like points of the scale bracts which protrude nearly two inches, and are often covered with globules of resin.

This handsome tree is one of the most beautiful of the genus and at the same time one of the rarest. It occurs wild only in the Santa Lucia mountains, California, at elevations of about 3,000 feet, where it was discovered by Coulter in 1830. According to Professor Sargent, its extermination in its native habitat is threatened by the destructive fires which are so frequent in the dry coast ranges of S. California.

Fortunately *Abies bracteata* grows well and produces its remarkable cones in the milder parts of England, where there are now a fair number of healthy trees. It was introduced into cultivation in 1853 by Wm. Lobb.

A specimen planted at Bayfordbury in 1906 is thriving. The photograph is that of a cone gathered from a fine tree at High Canons, Herts.

ABIES BRACHYPHYLLA (*Maximowicz*).

Gardeners' Chronicle, Vol. XII. p. 556 (1879).

Veitch's Man. Conif. ed. 2, p. 518 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 765 (1909).

A TREE attaining in its native habitats a height of over 100 feet and a girth of 16 feet, with a bark like that of a spruce. Branchlets greyish, glabrous, with prominent pulvini separated by deep grooves. Buds broadly conical, smooth, brownish, resinous.

Leaves on lateral branches, pectinate, those on the upper side directed upwards and outwards, in two lateral sets, with a V-shaped depression between them. Leaves linear, flattened, tapering at the base, with the apex rounded and slightly bifid, nearly an inch long and about one-fifteenth inch broad; upper surface dark green, lower surface with two conspicuous white bands of stomata.

Cones cylindrical, 4 inches long by $1\frac{1}{2}$ inch in diameter, purple at first, but becoming brown when mature. Scales very thin and flat, fan-shaped, $1\frac{1}{8}$ inch long by $\frac{3}{4}$ inch wide; bract much shorter than the scale, finely denticulate and tipped by a minute mucro. Seed with its wing about $\frac{3}{4}$ inch long.

This tree occurs in the central mountains of the main island of Japan, at 4,000 to 5,000 feet elevation. The date of introduction into cultivation is uncertain.

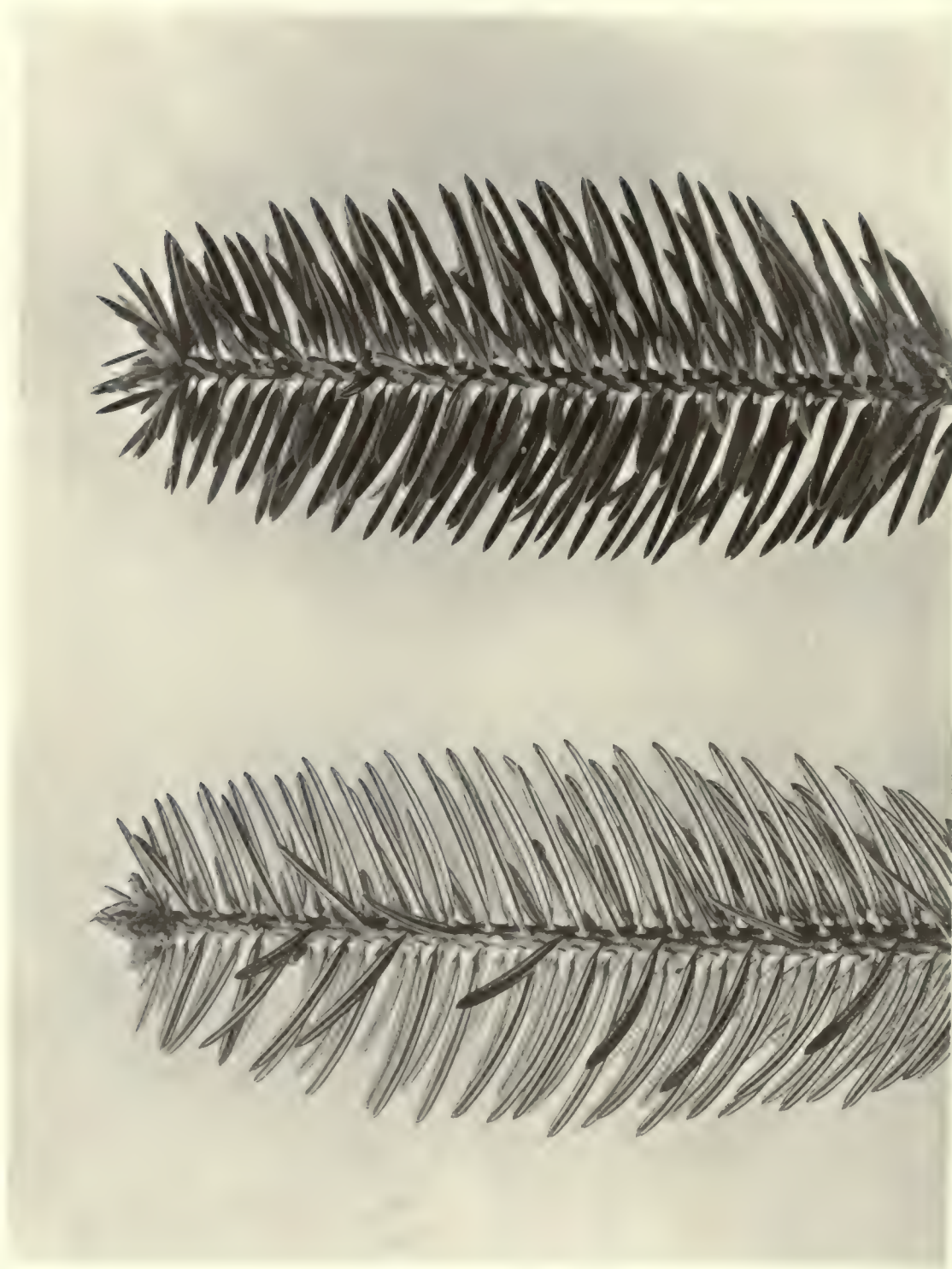
Specimens were added to the Bayfordbury collection in 1908. The cone photographed grew at Pampisford, Cambridge, and seedlings were raised from this source in 1907.



ABIES BRACHYPHYLLA.



ABIES BRACHYPHYLLA.



ABIES CEPHALONICA.



ABIES CEPHALONICA.

ABIES CEPHALONICA (*Loudon*). GREEK FIR.

Gardeners' Chronicle, Vol. XXII. p. 592 (1884) with fig.

Veitch's Man. Conif. ed. 2, p. 498 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 789 (1909).

A TREE attaining a height of about 100 feet with a stem 9 to 15 feet in girth. The bark, which is smooth and greyish-brown in young trees, becomes eventually fissured into small plates.

Buds conical or ovoid, resinous. Branchlets smooth, light-brown, glabrous. Leaves radially arranged, those of the upper ranks shorter than those beneath, linear, flattened, curved, rigid, about 1 inch long by one-sixteenth to one-twelfth inch broad, tapering at the base and ending in a long cartilaginous point; upper surface dark-green, shining, with several broken lines of stomata; lower surface with two white bands of stomata.

Cones about 6 inches long by $1\frac{1}{2}$ inch in diameter, cylindrical, brownish, with the bracts golden brown, exposed and reflexed. Scales narrowly fan-shaped; bract extending about three-quarters the length of the scale and ending in a triangular mucro which is exerted and reflexed over the edge of the scale next below; seed with wing about one inch long.

This species is a native of the higher mountains of Greece, between 2,700 and 5,700 feet elevation. On Mount Enos in Cephalonia there was formerly a forest of this fir 12 to 15 miles in length and 36 miles in circumference, but its area has been much reduced by fires.

Abies cephalonica was introduced into cultivation by General Sir Charles Napier, who sent seeds to England in 1824.

There is a good specimen of this tree at Bayfordbury measuring 70 feet high by 6 feet 11 inches in girth. It was planted in 1847.

ABIES CILICICA (*Carrière*).

Veitch's Man. Conif. ed. 2, p. 500 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 744 (1909).

A TREE which attains in Asia Minor 100 feet in height and 7 feet in girth. Bark ashy-grey in colour, smooth when young, but becoming fissured in old trees.

Branchlets greyish-brown with scattered short pubescence. Buds small, non-resinous, ovoid. Leaves pectinate, the upper ranks pointing outwards and upwards, forming a V-shaped depression between the two sets; on vigorous shoots the median leaves cover the upper side of the branchlet. Leaves slender, 1 to $1\frac{1}{4}$ inch long, by one-sixteenth inch wide, linear, flattened, tapering at the base; apex rounded or acute and slightly bifid; upper surface light-green, lower surface with two narrow greyish bands of stomata.

Cones cylindrical, 6-9 inches long by $2-2\frac{1}{2}$ inches in diameter in wild specimens, brownish when mature; scales very large, fan-shaped, $1\frac{1}{4}$ inch wide by seven-eighths inch long; bract extending to one-third or one-half the height of the scale, tipped with a short mucro; seed with wing $1\frac{1}{4}$ inch long. In cultivated specimens the scales are smaller and the bracts shorter.

The native habitats of *Abies cilicica* are in Asia Minor and northern Syria, where it occurs on the Lebanon and the Antitaurus forming forests in company with the cedar. It was discovered by Kotschy in the Cilician Taurus in 1853 at an elevation of 4,000 to 5,000 feet.

This fir was introduced about 1855, but is very scarce in collections. It was planted at Bayfordbury in 1908.

The cone photographed is under the average size and was grown at Durris, Kincardineshire.



ABIES CILICICA.



ABIES CILICICA.



ABIES CONCOLOR.



ABIES CONCOLOR.

ABIES CONCOLOR (*Lindley and Gordon*).

Gardeners' Chronicle, Vol. VIII. p. 748 (1890) with fig.

Veitch's Man. Conif. ed. 2, p. 501 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 777 (1909).

THIS fir attains in America a height of 100 feet or more with a maximum girth of 9 feet. Bark of old trees fissured. Buds large, broadly conical, resinous. Branchlets yellowish-green, minutely pubescent.

Leaves irregularly arranged, most of them curving upwards; those above shorter than those below; 2 to 3 inches long, one-twelfth inch broad, glaucous on both surfaces with lines of stomata, linear, flattened, slightly tapering at the base; apex acute or rounded but not notched.

Cones 3 to 5 inches long, by $1\frac{1}{4}$ inch in diameter, cylindrical, greenish or purple when growing, but becoming brown when mature; scales much broader than long, about 1 inch wide by $\frac{1}{2}$ inch long. Bracts concealed, minutely mucronate; seed with wing about $\frac{3}{4}$ inch long.

Abies concolor was discovered by Fendler near Santa Fé in 1847, but does not seem to have been introduced into cultivation until about 1873. It grows wild in the Rocky Mountains of southern Colorado and extends southwards over the mountains of New Mexico and Arizona into northern Mexico; it also occurs in Utah and in the extreme south of California.

Sargent and other American botanists consider this and *Abies Lowiana* to be forms of one species but they are certainly distinct in cultivation. *A. concolor* has large buds and leaves entire at the apex. *A. Lowiana* has smaller buds and leaves bifid at the apex. The arrangement of the leaves is also quite different in the two species. The cones are similar; but in the cultivated specimens of *A. concolor* the immature cones are violet with a peculiar iridescence and are remarkably sweet-scented.

The Bayfordbury specimen is 24 feet high, and was planted in 1840. The cone photographed represents a specimen produced by that tree.

ABIES FIRMA (*Siebold and Zuccarini*).

Gardeners' Chronicle, Vol. XII. pp. 198, 199 (1879).

Veitch's Man. Conif. ed. 2, p. 506 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 762 (1909).

A TREE attaining in Japan a height of 150 feet and a girth of 16 feet. Bark of trunk soon becoming rough, eventually fissuring into small plates. Branchlets brownish-grey, grooved, with short pubescence confined to the grooves. Buds small, ovoid, obtuse, with slightly resinous scales.

Leaves on lateral branches pectinate, in three to four ranks, those below spreading at right angles to the axis, those on the upper side gradually shortening to a third the length of the lower. Individual leaves up to $1\frac{1}{2}$ inch long, linear, flattened, coriaceous, the apex ending in two cartilaginous points; upper surface dark shining green, grooved; lower surface with two broad bands of stomata.

Cones cylindric, or conic-cylindric, yellowish-green before ripening, brown when mature, 4 to 5 inches long by $1\frac{1}{2}$ to $1\frac{3}{4}$ inch in diameter, with the tips of the bracts visible between the scales which are about an inch wide, transversely reniform, suddenly contracted to a short claw; bracts linear, spathulate, longer than the scale and terminating in an acuminate mucro.

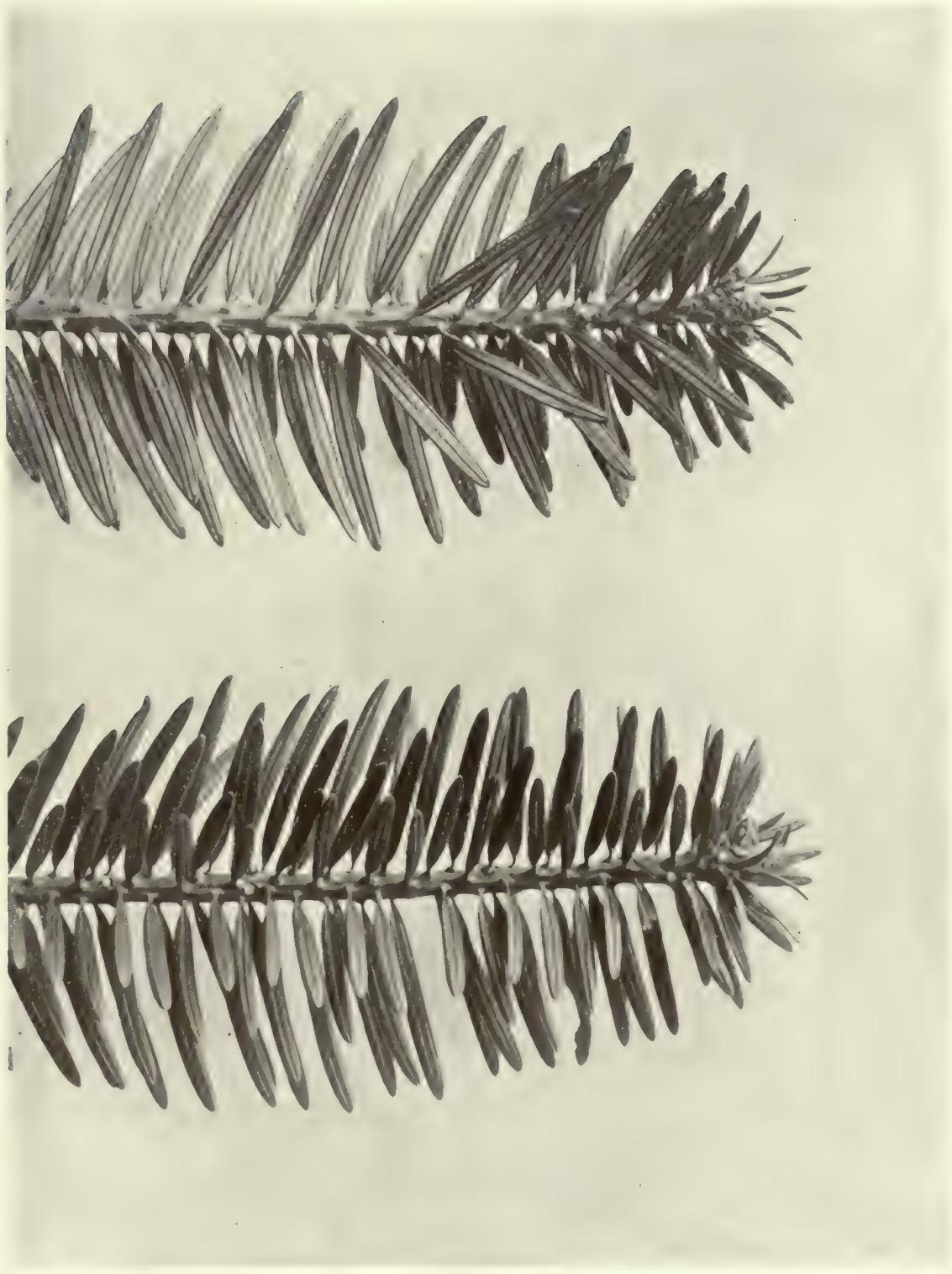
Mayr states that *Abies firma* is found wild within the warmer temperate region of Japan lying between the 34th and 36th parallels of latitude. In its northern limit it does not ascend higher than 700 feet but in the southern island it ascends to 7,000 feet. It is also largely planted as an ornamental tree; the timber is of little value.

This fir was discovered by Thunberg in 1777 and mistaken by him for *Abies pectinata*. It was first distinguished as a species by Siebold and Zuccarini in 1842 and introduced by J. G. Veitch in 1861. It is not common in cultivation.

The specimen at Bayfordbury is 31 feet high by 1 foot 10 inches in girth. The cone photographed was grown at High Canons, Herts.



ABIES FIRMA.



ABIES FIRMA.



ABIES FRASERI.



ABIES FRASERI.

ABIES FRASERI (*Poiret*).

Gardeners' Chronicle, Vol. VIII. p. 684 (1890) with fig.

Veitch's Man. Conif. ed. 2, p. 509 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 806 (1909).

A FIR attaining in America a height of 70 feet with a trunk 7 feet in girth, and somewhat stiff branches forming a tree with an open pyramidal habit. Bark smooth, thin and blistered in young trees, becoming scaly on older trunks.

Branchlets grey, with a dense reddish curved or twisted pubescence. Buds small, broadly ovoid or globose, resinous.

Leaves arranged like those of *A. balsamea*, but shorter, rarely exceeding $\frac{3}{4}$ inch in length, rounded and notched at the apex. Upper surface dark-green, shining; lower surface with two broad white bands of stomata.

Cones purple, ovoid-cylindrical, about 2 inches long by $1\frac{1}{4}$ inch in diameter, like those of *A. balsamea*, but with the bracts protruding and reflexed at their tip; seed with wing about $\frac{1}{2}$ inch long.

This fir has a very local distribution, being found wild only on the Alleghany Mountains in south-western Virginia, North Carolina, and eastern Tennessee, where it forms forests at 4,000 to 6,000 feet elevation. It was discovered by John Fraser, a Scotch traveller and botanist, whose name it commemorates, early in the 19th century. It is a short-lived species, and although introduced as long ago as 1811, no trees of considerable size are known in Britain.

Abies Fraseri planted at Bayfordbury in 1838 was killed by the winter of 1860. Specimens were added in 1906, one of which is now (1909) coning. The photograph represents a branch from a tree which formerly grew near Moreton-in-the-Marsh, Gloucestershire.

ABIES GRANDIS (*Lindley*). GIANT FIR.

Gardeners' Chronicle, Vol. XV. p. 179 (1881), with figs.

Veitch's Man. Conif. ed. 2, p. 510 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 778 (1909).

A VERY tall fir attaining in America a height of 300 feet and a girth of 16 feet. Bark in young trees smooth, but becoming fissured with age. Branchlets olive green, smooth, with a minute pubescence. Buds small, conical, resinous.

Leaves on lateral branchlets in a flat, pectinate arrangement, spreading in two lateral sets in one plane, the lower leaves twice as long as the upper, linear, up to 2 inches long, with a rounded and notched apex; upper surface dark shining green, grooved; lower surface with two white bands of stomata. The leaves when bruised have an aromatic scent.

Cones cylindric, 2 to 4 inches long by 1 to 1½ inch in diameter, slightly narrowed at the obtuse apex, light-green with concealed bracts; scales closely imbricated, crescent-shaped to fan-shaped, shortly clawed, bracts small, quadrangular, apiculate. Seed with wing about ⅔ inch long.

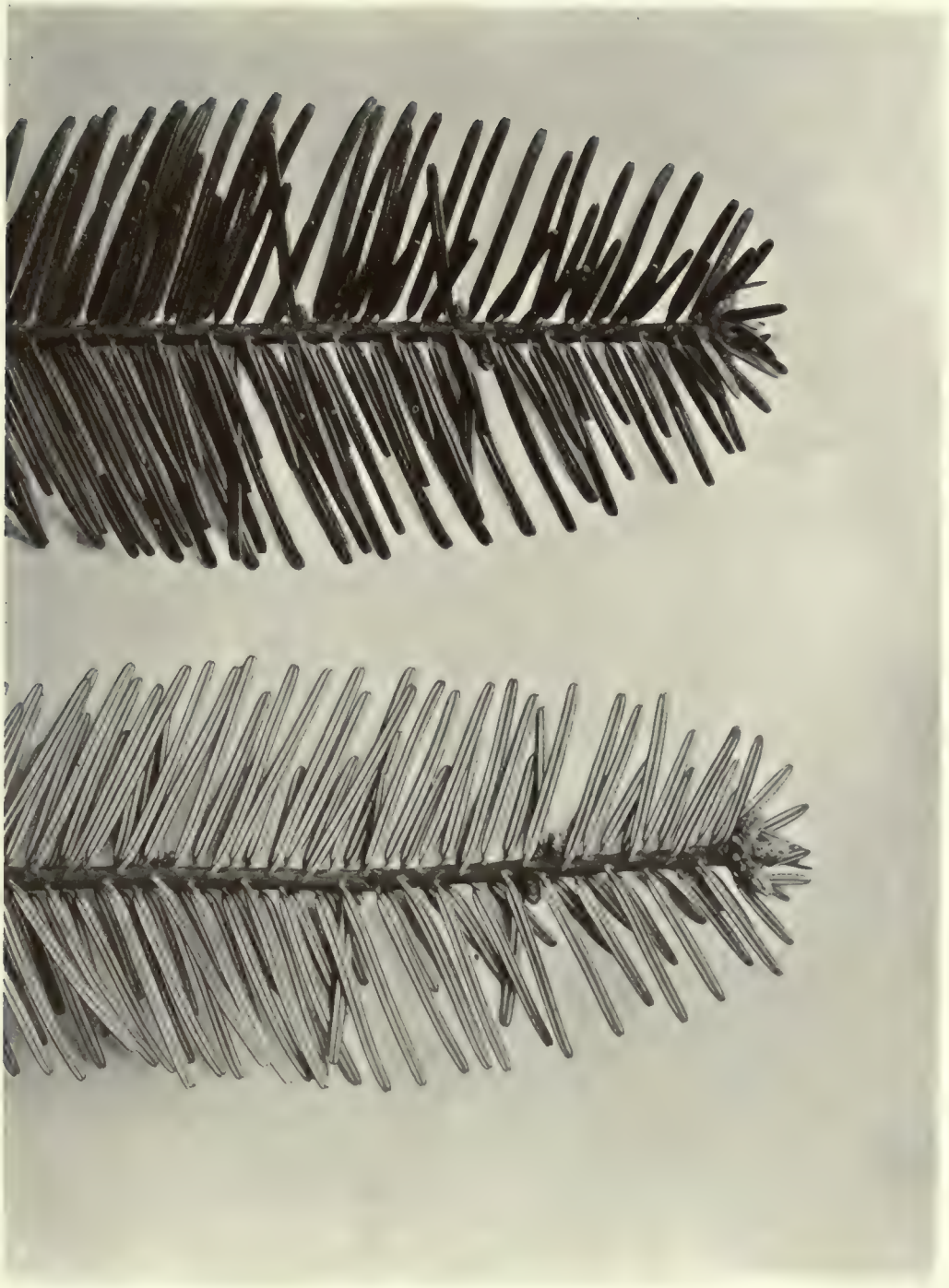
This fine tree, which grows very fast in its own country and in cultivation, is a native of the north-west coast of America from Vancouver Island through Washington and Oregon to the Mendocino Country, California; and spreads inland to the Cœur d' Alene and Bitter-root Mountains of Idaho and Montana, where it reaches an altitude of 4,000 feet.

Abies grandis was discovered on the Columbia River in 1825 by Douglas who sent seeds to the Horticultural Society, but very few of these germinated and it was not until 1851 that a further supply was received from Lobb. There are now many fine trees of this fir in the British Isles.

The specimen at Bayfordbury planted in 1849, has attained a height of 73 feet by 5 feet 9 inches in girth. The cone figured was obtained from a tree at Youngsbury, Ware.



ABIES GRANDIS.



ABIES GRANDIS.



ABIES LASIOCARPA.



ABIES LASIOCARPA.

ABIES LASIOCARPA (*Nuttall*). ROCKY MOUNTAIN FIR.

Gardeners' Chronicle, Vol. V. p. 172 (1889), with figs.

Veitch's Man. Conif. ed. 2, p. 515 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 800 (1909).

A TREE 80 to 175 feet high and 15 feet in girth. Bark of young trees silvery grey, becoming in old trees fissured and scaly, or occasionally corky and white. Branchlets ashy-grey, pubescent. Buds small, globose, conic, resinous.

Leaves on lateral branches irregularly pectinate or with most of the leaves directed upwards, those on the middle line above covering the shoot, those below pointing forwards and downwards, linear, up to $1\frac{1}{2}$ inch long, apex rounded and entire or slightly notched. Upper surface grooved with conspicuous lines of stomata on each side of the groove; lower surface with two broad bands of stomata giving the foliage a glaucous appearance.

Cones cylindric, rounded, truncate, or depressed at the apex, 2 to 4 inches long by $1\frac{1}{2}$ inch in diameter, dark-purple and downy, with the bracts concealed. Scales variable in shape, but usually longer than broad, gradually narrowed from a broad rounded apex to a short cuneate base, from $\frac{7}{8}$ inch long by $\frac{3}{4}$ inch wide to $\frac{1}{2}$ inch long by 1 inch wide. Bract quadrangular or orbicular with a long slender mucro. Seed $\frac{1}{4}$ inch long with dark purplish shining wings which vary in length.

This is the most widely-distributed fir of western America, and is essentially an Alpine species. It ranges from about lat. 61° N. in Alaska to the San. Francisco Mountains in northern Arizona. In the west it extends to the summits of the Olympic Mountains in Washington and in the east to the mountains of Idaho, Montana, Wyoming, Colorado and Utah. It descends to 2,500 feet in northern British Columbia and ascends in Colorado to an altitude of 10,000 feet.

This species was discovered by Douglas in 1832, but the date of introduction is uncertain. It is rarely seen in collections, being apparently not suited to the English climate.

The Bayfordbury specimen is now 14 feet high and coning. The illustration is from a photograph kindly sent from Washington by Mr. G. B. Sudworth. A young plant of the var. *arizonica*, adult trees of which are remarkable for the creamy white colour of the corky bark, was added in 1907.

ABIES LOWIANA (*Murray*). CALIFORNIAN FIR.

Gardeners' Chronicle, Vol. XIII. p. 8 (1880) with fig.

Veitch's Man. Conif. ed. 2, p. 502 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 779 (1909).

A TREE which attains in California a height of 200 to 250 feet with a trunk sometimes 18 feet in girth. Bark very thick on old trunks, dividing into scaly ridges; in cultivated trees resembling *A. concolor*.

Branchlets yellowish-green, minutely pubescent. Buds ovoid, smaller than in *A. concolor*, resinous.

Leaves on lateral branches, pectinate, horizontal or curving upwards; those on the upper side of the shoot nearly as long as the lower, linear, flattened, rounded and slightly notched at the apex, up to $2\frac{1}{2}$ inches long; upper surface grooved, with lines of stomata in the furrow; lower surface with two white bands of stomata.

Cones resembling those of *A. concolor*, but in cultivated specimens they are chestnut-brown and not purple as is sometimes the case in *A. concolor*.

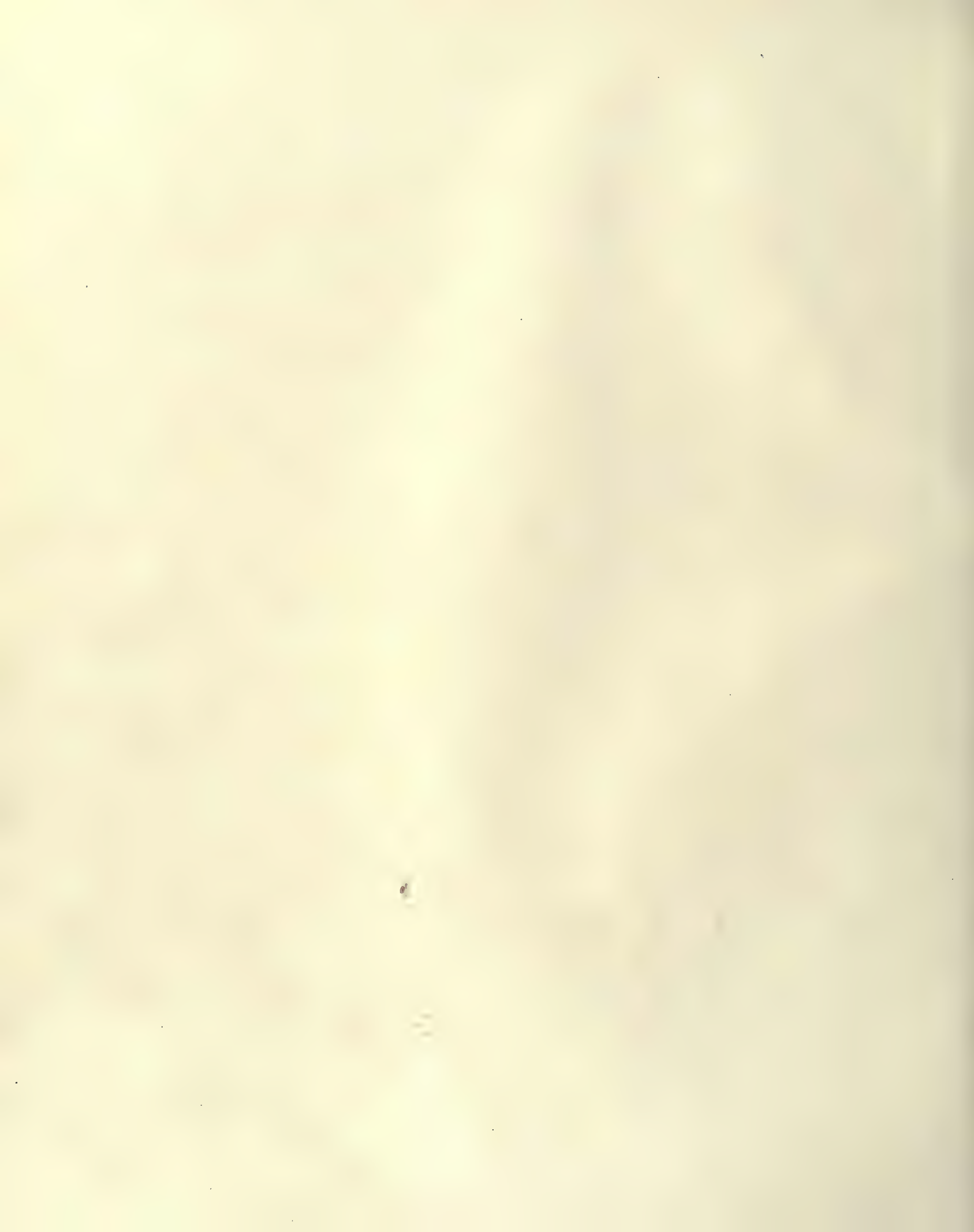
This fir is often regarded as a geographical form of *Abies concolor*, but it keeps perfectly distinct in cultivation as explained in the account of the latter species. Its native habitats are the Siskiyou Mountains in southern Oregon, and on Mount Shasta and the Sierra Nevada ranges in California. In the latter locality it forms forests with *Abies magnifica*, and extends from 4,000 to 9,000 feet altitude.

Abies Lowiana was introduced into cultivation in 1851 by Lobb, and has proved itself to be one of our hardiest conifers, growing well on a variety of soils.

The Bayfordbury specimen planted in 1849 has now attained a height of 69 feet by 6 feet 9 inches in girth. The cone photographed was produced by the Bayfordbury tree in 1907, and seedlings have been raised from that source.



ABIES LOWIANA.





ABIES LOWIANA.





ABIES MAGNIFICA.



ABIES MAGNIFICA.

ABIES MAGNIFICA (*Murray*). RED FIR.

Gardeners' Chronicle, Vol. XXIV. p. 652 (1885), with fig.

Veitch's Man. Conif. ed. 2, p. 516 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 792 (1909).

A TREE attaining in America a height of over 200 feet with a trunk 30 feet in girth. Bark thick, red-brown and deeply fissured. Cultivated specimens have always a characteristic habit, the trunk being straight and tapering with the branches very short and slender in proportion to the height and girth of stem, horizontally spreading and regularly whorled.

Branchlets clothed with a rusty-brown pubescence. Buds ovoid, globose, resinous. Leaves on lateral branches pectinate below; those on the upper side shorter, partially covering the shoot, appressed to the branchlet near their base and then curving upwards, greyish or glaucous-green, up to $1\frac{1}{2}$ inch long, linear, obscurely-quadrangular in section, apex rounded, entire, upper surface not grooved but with a central ridge and several rows of stomata; lower surface with two bands of stomata.

Cones large, cylindric, obtuse, 6-9 inches long by 3-5 inches in diameter, slightly tapering at the apex, purplish-violet at first but becoming brown when ripe, pubescent; scales triangular-cuneate; bracts lanceolate with a small mucro at the apex, about three-fourths as long as the scale. Seed about $\frac{1}{2}$ inch long with a wing a little exceeding that length.

This handsome tree grows wild on the mountains of southern Oregon and California, and is common on Mount Shasta between 6,000 and 8,000 feet elevation. It is also found on the western slopes of the Sierra Nevada at a similar elevation, forming extensive forests.

Abies magnifica was introduced in 1851 by John Jeffrey, and was first believed to be *A. amabilis*, but afterwards plants were distributed by Messrs. Veitch as *A. nobilis* var. *robusta*.

The Bayfordbury specimen, which is one of the best in England, now measures 55 feet, by 4 feet 9 inches in girth. It was planted in 1850. (See *Trees of Great Britain and Ireland*, Vol. IV. plate 222). The cone represented was produced by the Bayfordbury tree in 1907.

ABIES MARIESII (*Masters*).

Gardeners' Chronicle, Vol. XII. p. 788 (1879), with fig.

Veitch's Man. Conif. ed. 2, p. 520 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 771 (1909).

A tree attaining in Japan a height of 80 feet and a girth of 6 feet. Branchlets densely covered with a very distinct rusty pubescence. Leaves on lateral branches arranged as in *A. Nordmanniana*, the median leaves on the upper side nearly appressed to the stem, shorter than the lower leaves which spread outwards and slightly forwards, linear, flattened, tapering at the base and widest in their upper third; apex round and bifid; upper surface yellow-green, shining; lower surface with two white bands of stomata.

Cones ellipsoid, about 4 inches long and 2 inches in diameter, violet when young, dark-brown when mature. Scales fan-shaped; seed-wing nearly twice the length of the seed.

Abies Mariesii was discovered by Maries in 1878 on Mount Hakoda. It occurs in the mainland of Japan and in Formosa at high altitudes from 5,000 to 7,000 and 10,000 feet. The cones figured are a reproduction of a drawing supplied by the Yokohama Nursery Company.

Three specimens were planted at Bayfordbury in 1908.



ABIES MARIESII.



ABIES MARIESII.



ABIES NOBILIS.

18^d



ABIES NOBILIS (*Lindley*).

Gardeners' Chronicle, Vol. XXIV. p. 652 (1885), with fig.

Veitch's Man. Conif. ed. 2, p. 521 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 786 (1909).

A TREE attaining in America a height of 150 to 250 feet and often 24 feet in girth. Bark smooth at first, becoming reddish-brown in old trees, and deeply divided by broad flat ridges. Cultivated specimens have the trunks frequently marked by large resinous blisters.

Young branchlets clothed with a rusty-brown pubescence. Buds resembling those of *A. magnifica*. Leaves closely set, those below spreading outwards in two lateral sets; the middle ones above completely covering the shoot, appressed to the stem for a short distance at their bases and then curving upwards, up to $1\frac{1}{4}$ inch long, linear, flattened, rounded and entire at the apex, grooved above; dull, bluish-green with bands of stomata on the lower surface.

Cones very large, cylindrical, but narrowing slightly upwards, 6 - 10 inches long by 3 - 4 inches in diameter in cultivated trees, but only about half this size in wild specimens; purplish-brown, with green bracts when growing, the bracts becoming brown as the cone ripens. Scales triangular with an awl-shaped claw, bracts longer than the scales, strongly reflexed. Seed about $\frac{1}{2}$ inch in length with a wing considerably longer.

Abies nobilis, which was discovered near the Grand Rapids of the Columbia River in 1825 by David Douglas, forms large forests along the slopes of the Cascade Mountains of Washington and Oregon, with a vertical range of 2,500 to 5,000 feet elevation. It also occurs on the coast ranges of Washington and the Siskiyou Mountains of California. The wood is strong and durable and is used generally for constructive purposes.

This is one of our most ornamental firs, and the many fine specimens in cultivation show its adaptability to the English climate. It was introduced about 1830.

There are two good specimens at Bayfordbury measuring respectively 58 feet by 5 feet 9 inches and 64 feet by 5 feet 8 inches. The latter tree belongs to the variety *glauca*. Both were planted in 1845. The cone photographed was obtained from a young tree at Eastnor Castle in 1908.

ABIES NORDMANNIANA (*Spach*). CAUCASIAN FIR.

Gardeners' Chronicle, Vol. XXV. p. 142 (1886), with fig.

Botanical Magazine, t. 6992 (1888).

Veitch's Man. Conif. ed. 2, p. 526 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 746 (1909).

A TALL tree attaining a height of 200 feet with a girth of 9 to 15 feet in the Caucasus.

Bark of trunk brownish-grey, smooth or slightly fissured. Young shoots grey, with scattered brown pubescence. Buds ovoid with broad, brown, non-resinous scales. Leaves pectinately arranged below in two lateral sets; those above shorter and densely covering the branchlet in imbricated ranks, bright green, persistent seven to ten years, narrow, linear, notched at apex, $\frac{3}{4}$ - 1 inch long, grooved above, with white bands of stomata beneath.

Cones cylindrical, dark brown, about 6 inches long by 2 inches broad, covered with a resinous exudation. Scales broad, very obtuse; bracts cuspidate with the point reflexed over the lower scale. Seed with wing about an inch long.

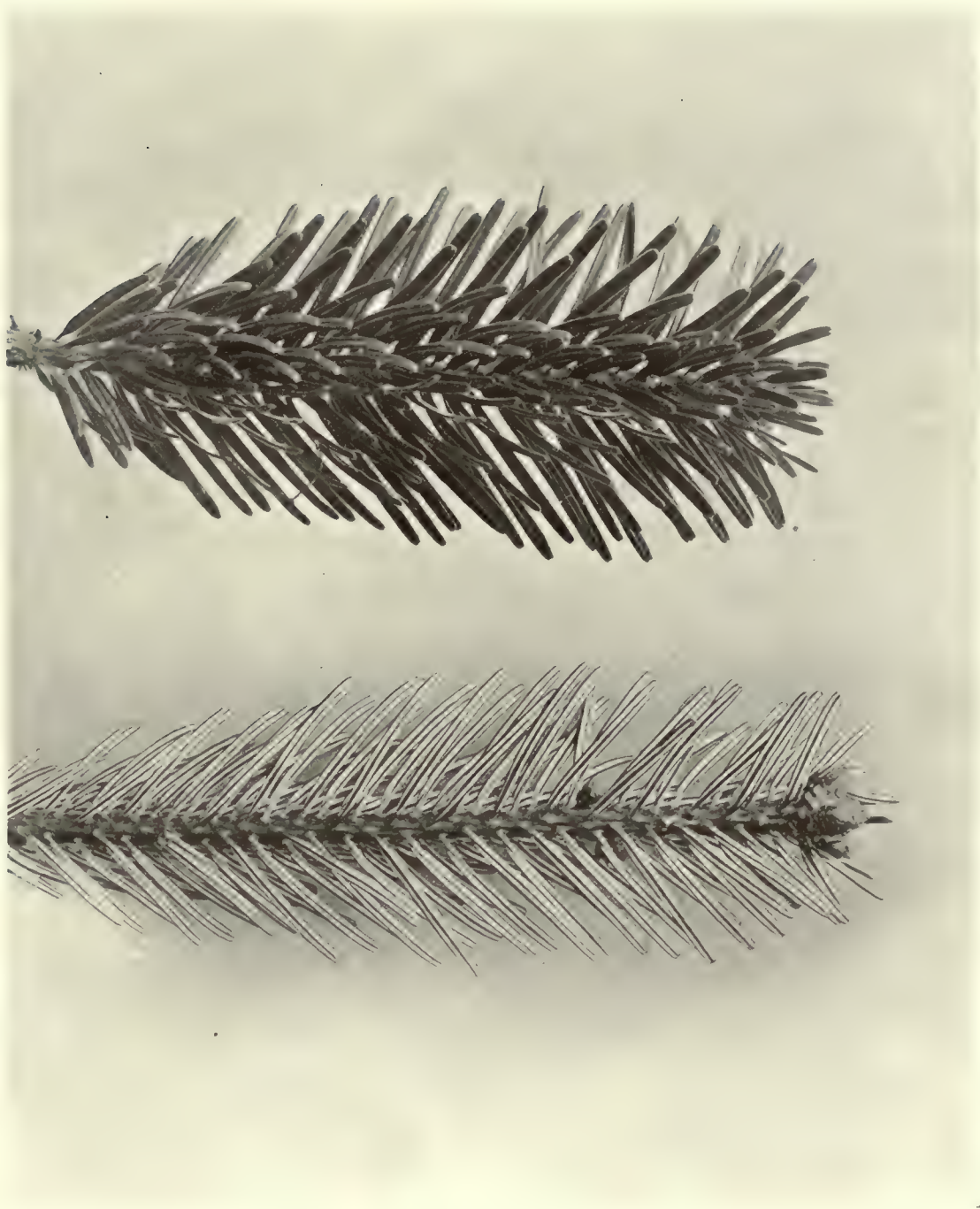
Abies Nordmanniana is one of the best known and most useful trees for ornamental planting, and will grow on almost any soil. It is a native of the Caucasus and northern Asia Minor, and was introduced into European gardens in 1848. The timber is said to be of excellent quality.

This species was planted at Bayfordbury in 1849, the largest specimen now measuring 84 feet by 7 feet.



ABIES NORDMANNIANA.

ABIES NORDMANNIANA.





ABIES NUMIDICA.



ABIES NUMIDICA.

ABIES NUMIDICA (*De Lannoy*). ALGERIAN FIR.

Gardeners' Chronicle, Vol. III. p. 140 (*in part and excluding figures*) (1888).

Veitch's Man. Conif. ed. 2, p. 529 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 737 (1909).

A TREE attaining 70 feet in height and 8 feet in girth. Bark grey and smooth in young trees, becoming scaly and fissured with age. Branchlets brown and glabrous. Buds large, ovoid, non-resinous.

Leaves on lateral branches pectinate below, those above shorter, crowded, directed upwards, with the median leaves on strong shoots directed backwards and covering the upper side of the branchlet. Leaves short and broad, $\frac{1}{2}$ to $\frac{3}{4}$ inch long by one-twelfth inch broad, flattened; upper surface dark shining green with a few lines of stomata near the apex; under surface with two white bands of stomata; apex rounded, entire or bifid.

Cones cylindric, brownish in colour, 5 inches long by $1\frac{1}{2}$ inch in diameter; scales fan-shaped $1\frac{1}{4}$ inch wide by $\frac{3}{4}$ inch long or smaller in cultivated specimens; bracts concealed, half to quarter as long as the scale; seed with wing about an inch long.

This fir is only known to occur wild in Algeria where it occupies a small area towards the summit of Mount Babor in the Kabylie range at from 5,000 to 6,600 feet altitude. It was discovered in 1861 by Captain de Guibert, and introduced into cultivation the following year.

The Algerian fir is rare in cultivation and was not planted at Bayfordbury until 1906. The specimens illustrated were grown at Pampisford, Cambridge.

ABIES PECTINATA (*De Candolle*). COMMON SILVER FIR.

Veitch's Man. Conif. ed. 2, p. 590 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 720 (1909).

A TREE attaining in cultivation under favourable conditions a height of 130 feet or more with a girth of 16 feet. Trunk straight and tapering, often bare of branches for the greater part of its length.

Bark of trunk smooth when young, becoming rough, fissured and scaly in old age. Branches short, spreading horizontally; branchlets grey with scattered pubescence.

Buds small, ovoid, non-resinous. Leaves pectinate, the lower ones longer and spreading outwards, the upper ones directed upwards and outwards, forming between the two sets a narrow V-shaped depression, about 1 inch long, linear, flattened, with a rounded minutely notched apex; upper surface dark green and shining; lower surface with two white bands of stomata.

Cones on short stout stalks, cylindrical, slightly narrowed at both ends, 6-8 inches long by about 2 inches in diameter, greenish when young but becoming brown when mature; scales tomentose externally, fan-shaped; bracts linear-spathulate, terminating in a long reflexed mucro; seed with wing about an inch long.

The common Silver fir has an extensive range in the mountainous regions of central and southern Europe. In France and Germany it often forms large forests, and is also largely planted.

Abies pectinata was introduced into England about 1600, and thrives in the south and west of England and in Scotland and Ireland, where there are many fine specimens; old trees on account of their great height are often damaged by the wind, their tops becoming ragged and broken. The timber is said to be superior to that of spruce for constructive purposes, but is little used in England.

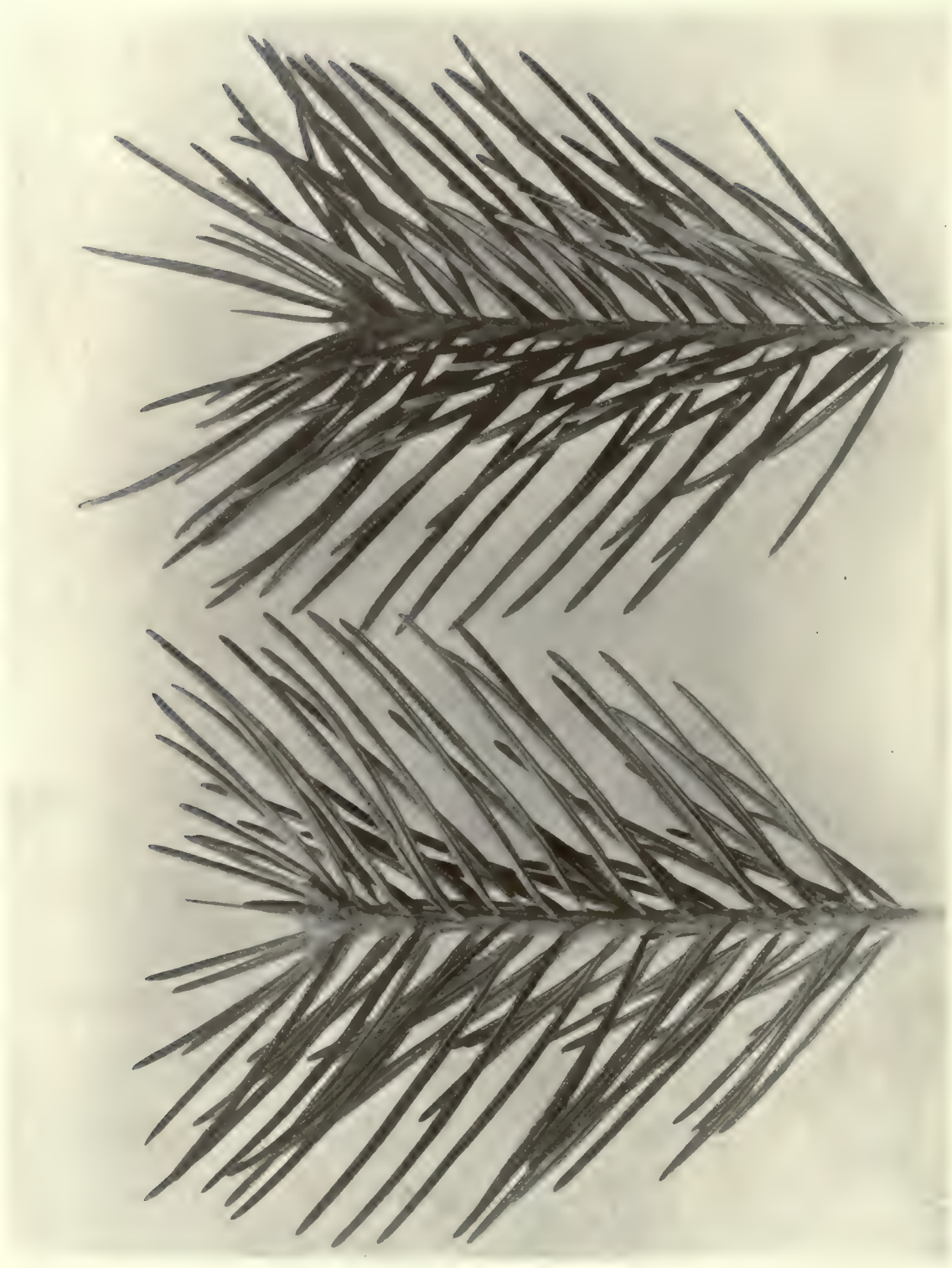
The tallest specimen at Bayfordbury has attained a height of 110 feet.



ABIES PECTINATA.



ABIES PECTINATA.



ABIES PINDROW.



ABIES PINDROW.

ABIES PINDROW (*Spach*).

Gardeners' Chronicle, Vol. XXV. p. 691 (1886) with fig.

Veitch's Man. Conif. ed. 2, p. 588 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 755 (1909).

A TREE of narrow pyramidal habit with branches short and more or less deflexed, attaining a height of over 200 feet and a girth of 25 feet. Bark of trunk greyish-brown, with deep longitudinal fissures when old.

Young branchlets glabrous, smooth. Buds large, globose, encrusted with resin. Leaves on lateral branchlets irregularly arranged, those below mostly pectinate, with some directed downwards; those above covering the branchlet, the middle ones much shorter and pointing forwards; linear, flattened, up to $2\frac{1}{2}$ inches long, tapering to the unequally bifid apex; upper surface dark shining green and grooved; lower surface with two greyish bands of stomata.

Cones cylindric, obtuse, 4-5 inches long, by about 3 inches in diameter, violet-purple, changing to dark brown when mature; scales sub-rhomboidal with a small wedge-shaped claw; bracts about a third as long as the scale. Seed with wing about an inch long.

This fir is a native of the Himalayas from Chitral to Nepal, occurring at lower levels than its near ally *Abies Webbiana*, and has a more restricted distribution. It is found at elevations of 7,000 to 10,000 feet, and according to Madden forms dense forests on all the great spurs of Kumaon and also spreads westward into Kashmir.

Abies Pindrow was introduced into cultivation about 1837, when young plants were raised by the Horticultural Society from cones presented by Dr. Royle.

This species was first planted at Bayfordbury in 1852, but did not survive the severe winter of 1860. There is tree in Black Fan wood measuring 32 feet in height by 1 foot 5 inches in girth. A young tree was planted in the Pinetum in 1906.

ABIES PINSAPO (*Boissier*). SPANISH FIR.

Gardeners' Chronicle, Vol. XXIV. p. 468 (1885), with fig.

„ „ Vol. XXVI. p. 8 (1886), with fig.

„ „ Vol. III. new series, p. 140 (1888), with fig.

Veitch's Man. Conif. ed. 2, p. 584 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 782 (1909).

A TREE, attaining a maximum height of 100 feet with a trunk 15 feet in girth. Bark greyish-brown, smooth when young, fissured when old. Young branchlets glabrous, slightly grooved. Buds ovoid, obtuse, resinous.

Leaves on lateral branchlets spirally arranged, linear, flattened, thick and rigid, not more than $\frac{3}{4}$ inch long, gradually tapering to the acute apex, occasionally curved; upper surface convex, not furrowed, with stomatic lines; lower surface with two bands of stomata.

Cones brownish when mature, pubescent, cylindrical, tapering to an obtuse apex, 4-5 inches long by $1\frac{1}{4}$ - $1\frac{3}{4}$ inches in diameter, but smaller in cultivated examples; scales triangular-cuneate, clawed; bracts ovate, mucronate, much shorter than the scales. Seed with wing $1\frac{1}{4}$ inch long.

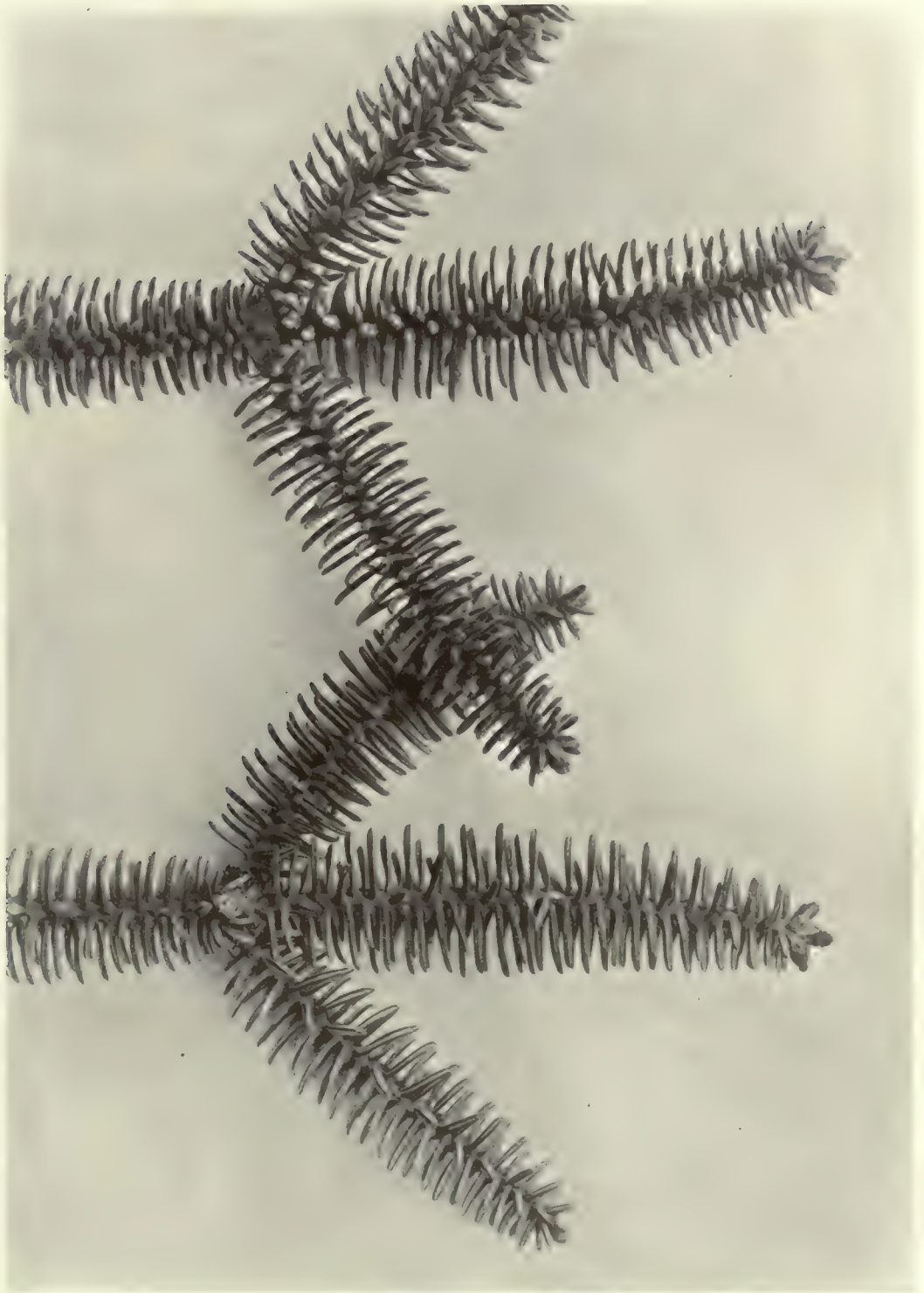
This fir is only known in a wild state on the Serrania de Ronda in the south of Spain, where it forms forests at from 3,500 to 6,000 feet altitude. It was discovered by Edmond Boissier in 1837, and introduced into England in 1839 by Captain Widdrington. As a cultivated tree it is one of the most ornamental species of the genus and thrives on limestone.

The best tree at Bayfordbury now measures 55 feet by 5 feet 10 inches. The date of planting is not recorded.

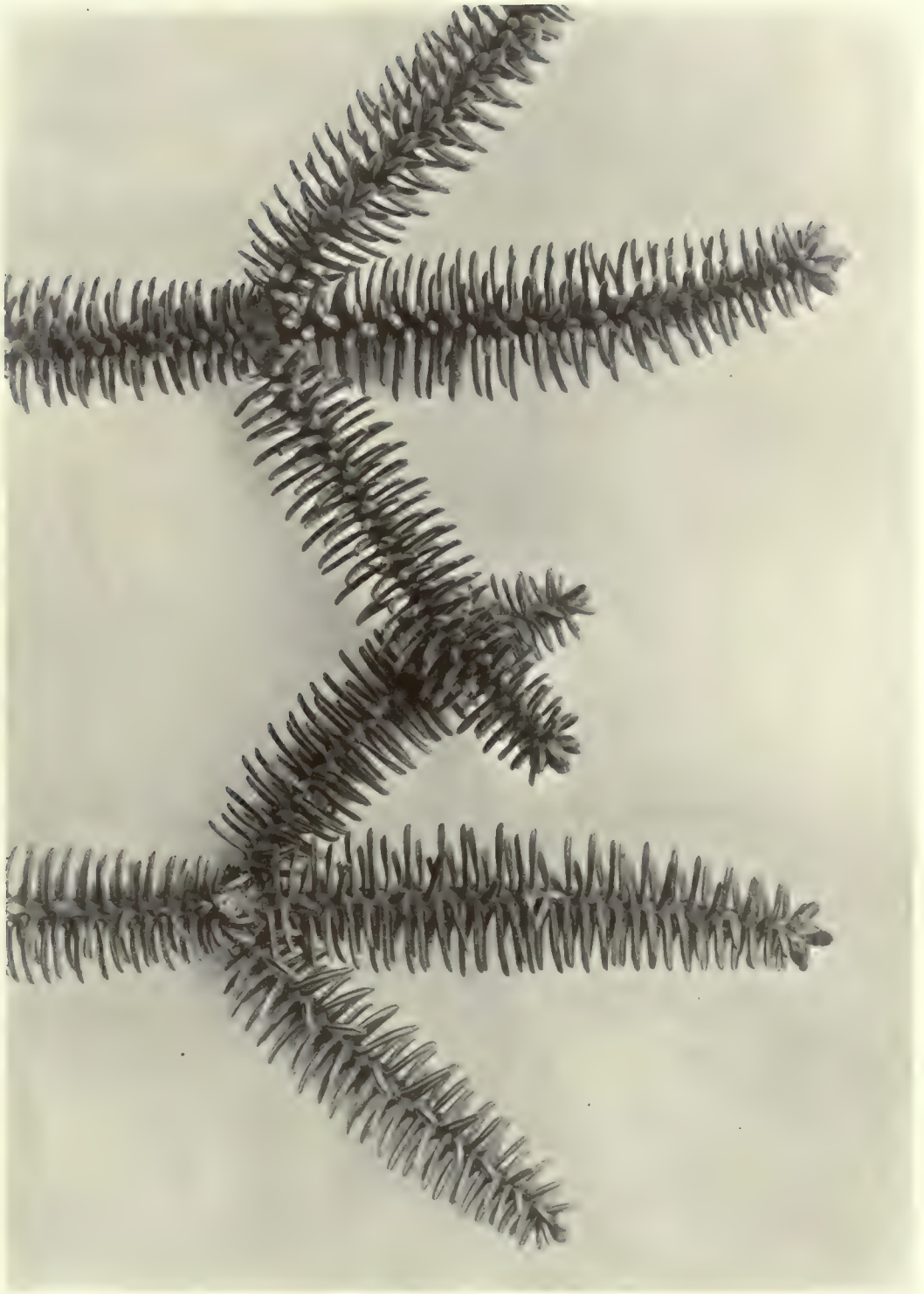


ABIES PINSAPO.

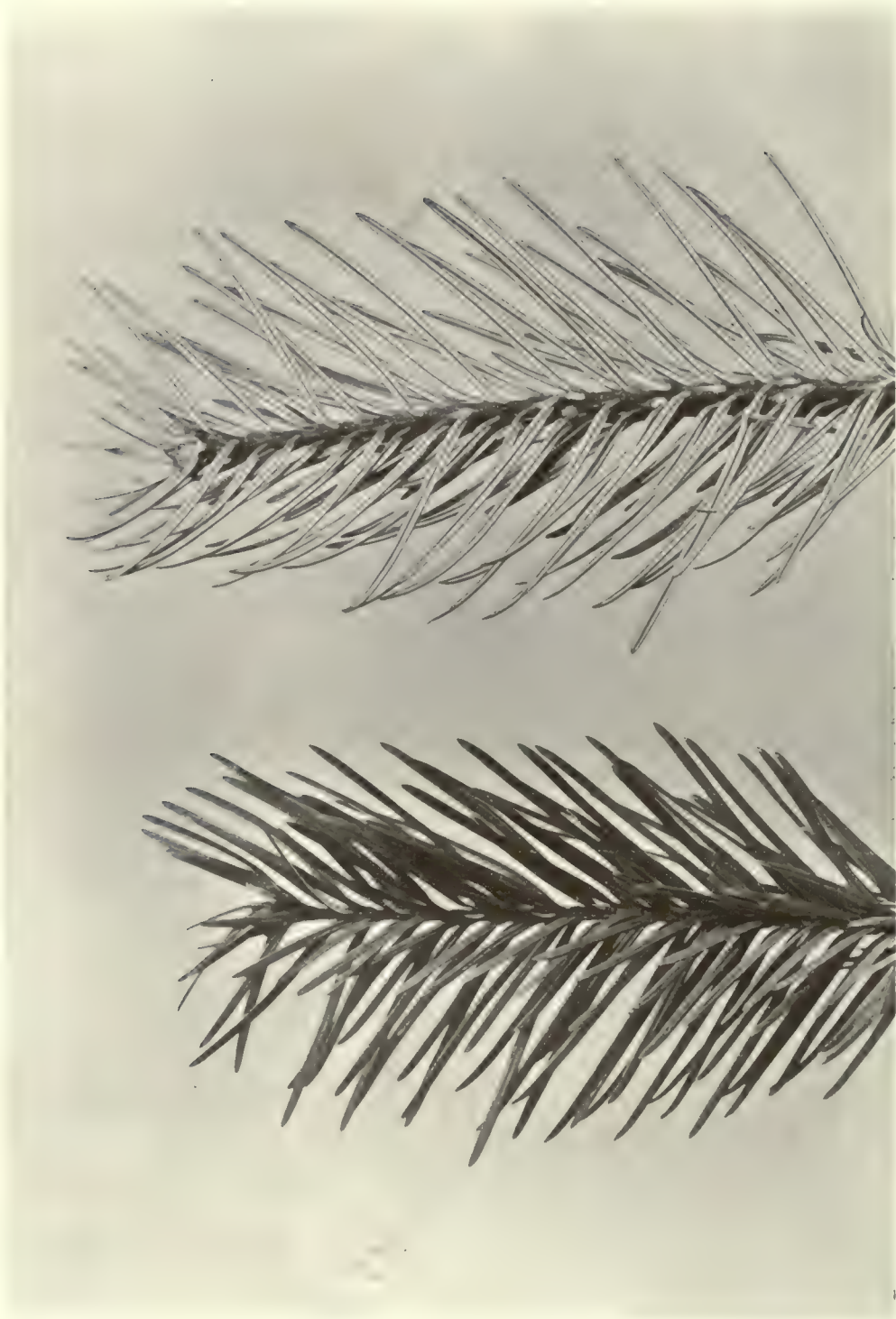




ABIES PINSAPPO.



ABIES PINSAPO.



ABIES RELIGIOSA.



ABIES RELIGIOSA.

ABIES RELIGIOSA (*Schlechtendal*). MEXICAN FIR.

Gardeners' Chronicle, Vol. IX. p. 804 (1891) with figs.

Veitch's Man. Conif. ed. 2, p. 586 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 808 (1909).

A tree attaining a height of 150 feet and a girth of 15 feet. Bark rough and grey. Young shoots brown on the upper side, olive-green on the lower side, covered with minute pubescence. Buds cylindrical, rounded at the apex and resinous.

Leaves on lateral branches rather thinly set; those on the upper side pointing forwards and slightly upwards; those on the lower side spreading outwards and forwards. Leaves 1 - 1½ inch long, the upper shorter than those below; upper surface shining dark green; lower surface with two whitish lines of stomata.

Cones 4 inches long and 2 inches in diameter, on short stalks, broad at the base and tapering above, blue when young, changing to brown when mature, with long reflexed bracts. Seed with wing about ¾ inch long.

Abies religiosa occurs throughout the mountains of central and southern Mexico and of northern Guatemala, at altitudes of 4,000 to 10,000 feet. It was discovered by Humboldt in 1799, and introduced by Hartweg in 1838. In cultivation it is tender, and will only grow in the milder parts of the British Isles. It is the Oyamel of the Mexicans, who use the branches for decorating their churches.

The tree planted at Bayfordbury in 1851 was killed by the winter of 1860. The specimen illustrated was grown at Fota Island, Cork.

ABIES SACHALINENSIS (*Masters*).

Gardeners' Chronicle, Vol. XII. p. 588 (1879) with fig.

Veitch's Man. Conif. ed. 2, p. 587 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 760 (1909).

A TREE attaining in its native habitats a height of 100 to 130 feet with a girth of 9 feet. Bark smooth and grey. Branchlets grey, with a short dense pubescence in the well-marked grooves. Buds small, ovoid-globose, resinous.

Leaves on lateral shoots, with those below pectinate, longest and directed outwards and forwards; those above covering the branchlets in imbricated ranks, the median leaves directed forwards and appressed to the shoots, about $1\frac{1}{2}$ inch long, very slender; apex slightly bifid; upper surface light-green; lower surface with two well-defined bands of stomata.

Cones cylindrical, $3\frac{1}{2}$ inches long and $1\frac{1}{4}$ inches in diameter, with large reflexed bracts which nearly conceal the scales. Seed with wing $\frac{3}{8}$ inch long.

Abies sachalinensis was discovered in 1866 by Schmidt in Saghalien, and seed was sent to England in 1879 by Maries who had found this fir the previous year in Yezo. It is a native of the Kuriles, Saghalien and north Japan, occurring from sea-level to 4,000 to 5,000 feet. The timber is useful for general constructive purposes. In cultivation this species is rare and does not succeed, the young growth being cut by spring frosts. The figure of true *sachalinensis* is from a native specimen.

In the var. *nemorensis* found in the Kuriles and north-east Yezo the cones are smaller, and the bracts very small and concealed. The illustration of this cone is from a specimen collected by Captain Clinton-Baker, R.N.



ABIES SACHALINENSIS.



ABIES SACHALINENSIS. var. NEMORENSIS.



ABIES SACHALINENSIS.



ABIES SIBIRICA.

ABIES VEITCHII (*Lindley*).

Gardeners' Chronicle, Vol. XIII. p. 275 (1880).

Veitch's Man. Conif. ed. 2, p. 541 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 768 (1909).

A TREE attaining a height of 70 feet with a girth of 7 feet. Bark of trunk grey and smooth. Branchlets smooth and more or less covered with short dense pubescence. Buds subglobose, small, purple, resinous. Leaves on lateral branches; those on the under side pectinate; those on the upper side shorter and covering the branchlet, the median ones pointing upwards and forwards. Leaves $\frac{1}{2}$ - 1 inch long, one-sixteenth inch wide, with a bifid apex; upper surface dark green; lower surface with two silvery broad bands of stomata.

Cones cylindrical, about 2 - 2 $\frac{1}{2}$ inches long and $\frac{3}{4}$ - 1 inch in diameter, purple when young, brown when mature. Scales small; bracts as long as the scales and slightly protruding. Seed with wing $\frac{5}{8}$ inch long.

Abies Veitchii was discovered in 1860 by J. G. Veitch, and introduced into England by Maries in 1879. It grows on Fuji-yama and on other mountains in the main island of Japan at altitudes above 5,000 to 6,000 feet.

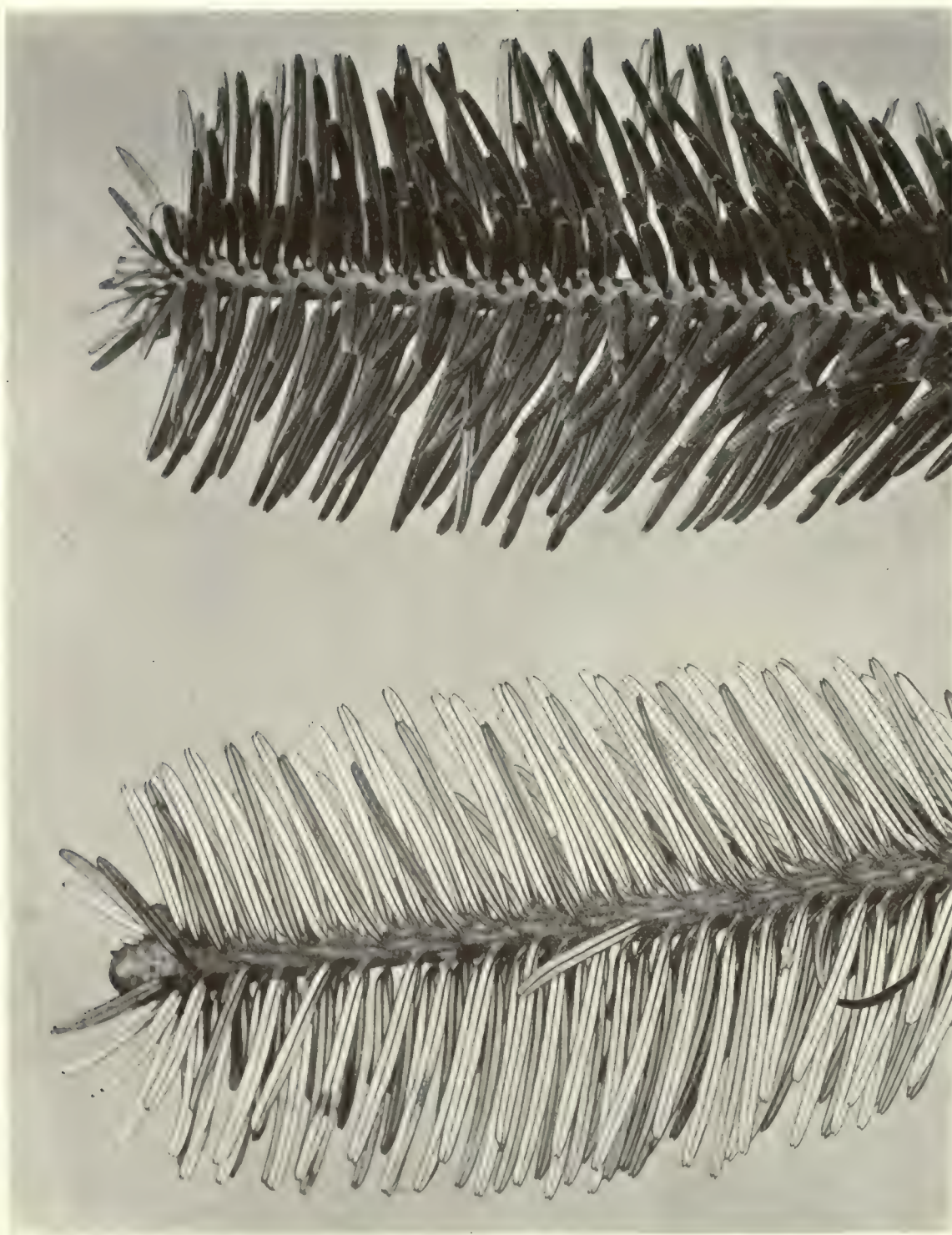
Specimens were added to the Pinetum at Bayfordbury in 1906. The cone figured is a native specimen.



ABIES VEITCHII.



ABIES VEITCHII.



ABIES WEBBIANA.



ABIES WEBBIANA.

ABIES WEBBIANA (*Lindley*). HIMALAYAN FIR.

Gardeners' Chronicle, Vol. XXII. p. 467 (1884).

Veitch's Man. Conif. ed. 2, p. 548 (1900).

Trees of Great Britain and Ireland, Vol. IV. p. 750 (1909).

A TREE attaining a height of 150 feet and a girth of 35 feet. Branches thick, horizontal and spreading, forming a more or less flattened crown. Bark scaling off in young trees, becoming rough and fissured in old trunks.

Branchlets reddish-brown, deeply grooved, with minute hairs in the grooves. Buds large, globose and resinous. Leaves on lateral branches pectinately arranged in two lateral sets, each of several apparent ranks; the lower ranks on each side extending outwards in the horizontal plane; the upper ranks with leaves becoming gradually shorter, directed outwards and upwards, forming a V-shaped depression with the branchlet visible between them.

Leaves 1 - $2\frac{1}{2}$ inches long, linear, flattened, rounded and bifid at the apex, upper surface dark green and grooved, lower surface with two well defined white lines of stomata.

Cones shortly stalked, cylindrical, in cultivation often 6 - 8 inches long by 2 - 3 inches in diameter, violet or plum-coloured when growing, becoming brown when mature; scales fan-shaped, suddenly contracted to a short claw with entire margins; bracts spathulate, mucronate, nearly as long as the scale. Seed with a wing one and a half times its length.

Abies Webbiana occurs in the inner Himalayas from Afghanistan to Bhotan at elevations of 10,000 to 14,000 feet. It was discovered by Captain W. S. Webb, an officer in the service of the East India Company, and introduced into English gardens in 1822 by Dr. Wallich of Calcutta. It does not succeed in England on account of its liability to be cut by spring frosts.

This tree was first planted at Bayfordbury in 1841 but was killed in 1854. A young specimen was added in 1906, and many seedlings raised from a cone grown at Castle Kennedy from which the photograph was taken.

P I C E A.

EVERGREEN trees belonging to the tribe Abietineæ of the order Coniferæ, with branchlets bearing in spiral order peg-like projections or pulvini from which the leaves arise singly. Leaves needle-like either quadrangular or flattened in section, persisting for many years and rendering the foliage very dense. Buds terminal and lateral, non-resinous.

Flowers monœcious. Staminate flowers solitary in the axils of the uppermost leaves, ovoid or cylindric, with scale-like bracts at the base, composed of numerous stamens spirally arranged. Pistillate flowers or young cones solitary, terminal, erect, stalked, composed of rounded or pointed scales, each in the axil of a bract, ovules two on each scale.

Cones ripening in one year, pendulous, cylindrical or ovoid, with the bracts minute and concealed, the scales enlarged and bearing on their inner surface two winged seeds.

About eighteen species of spruce occur in Europe, Asia Minor, Caucasus, Siberia, Mongolia, China, Japan, Himalayas and North America. The genus is divided into two sections, one including the flat-leaved species, and the other comprising those with quadrangular leaves.

KEY TO PICEA.

SECTION I.

LEAVES FLATTENED WITH STOMATA ONLY ON THE DORSAL SURFACE.¹I. *Branchlets glabrous.*

- P. ajanensis*, Fischer. Buds broadly conic, with scales rounded in margin. Leaves thin, slightly keeled on both surfaces, blunt or ending in short points; those on the upper side of the shoot more or less imbricate in arrangement, those below spreading laterally in two ranks.
- P. sitchensis*, Carrière. Buds ovoid with obtuse scales. Leaves deeply keeled on the ventral green surface, almost convex on the dorsal white surface, ending in sharp, thorn-like cartilaginous points; arranged as in *P. ajanensis*.
- P. spinulosa*, Henry. Buds ovoid with obtuse scales. Leaves deeply keeled on both surfaces, slender, sharp-pointed; in an imperfect radial arrangement.

II. *Branchlets pubescent with short hairs.*

- P. Omorika*, Bolle. Branchlets with brown pubescence. Buds ovate-conic, with outer scales ending in long subulate points. Leaves flattened but thick, obtuse, or ending in a short point, arranged as in *P. excelsa*.
- P. Breweriana*, Watson. Branchlets pendulous, with grey pubescence. Buds ovoid, with outer scales ending in long points. Leaves scarcely flattened, but convex above and below, keeled on the dorsal surface, with midrib prominent on the ventral green surface; radially arranged on the branchlets.

SECTION II.

LEAVES QUADRANGULAR WITH STOMATA ON ALL FOUR SIDES.

I. *Branchlets glabrous.*²

A.—LEAVES OF LATERAL BRANCHES RADIALY ARRANGED.

- P. Morinda*, Link. Branchlets grey, pendulous. Buds large, ovoid, acute; lower scales keeled, cuspidate-acuminate. Leaves slender, $1\frac{1}{2}$ to 2 inches long.

B.—LEAVES OF LATERAL BRANCHLETS IN AN IMPERFECT RADIAL ARRANGEMENT.

- P. Schrenkiana*, Fischer and Meyer. Branchlets grey, not pendulous. Buds dome-shaped; lower scales keeled, pointed, margins ciliate, not recurved. Leaves stiff, about an inch long, with sharp cartilaginous points.
- P. pungens*, Engelmann. Branchlets grey, not pendulous. Buds ellipsoid, with dry scarious scales, margins recurved, not ciliate. Leaves stiff, $\frac{3}{4}$ inch long, sharp pointed.
- P. polita*, Carrière. Branchlets yellow, not pendulous. Buds dome-shaped, reddish brown, shining; lower scales ovate, acute, keeled. Leaves stiff and prickly, an inch long, falcate.

C.—LEAVES OF LATERAL BRANCHES, ON THE UPPER SIDE OF THE SHOOT MORE OR LESS IMBRICATE IN ARRANGEMENT, THOSE BELOW SPREADING LATERALLY IN TWO RANKS.

- P. alba*, Link. Branchlets reddish brown or slightly glaucous. Buds ovoid; lower scales keeled, pointed, not scarious or ciliate. Leaves short, not more than $\frac{1}{2}$ inch long, often curved, sometimes glaucous, disagreeable in odour when bruised.
- P. Alcockiana*, Carrière. Branchlets whitish. Buds ovoid; scales with ciliate margins, lower ones acute and keeled. Leaves slender, about $\frac{1}{2}$ inch long, with two inconspicuous bands of stomata each of two lines on the ventral surface, and five or six conspicuous lines on the dorsal surface.

¹ In rare cases, broken lines of stomata are present on the ventral surface.² In some specimens of *Picea excelsa* the shoots are quite glabrous.

II. *Branchlets pubescent.*¹

LEAVES OF LATERAL BRANCHES NOT RADIALY ARRANGED.

A.—BUDS WITH SUBULATE OUTER SCALES.

P. nigra, Link. Shoot densely pubescent with whitish hairs. Leaves short, bluish-green or dark green, $\frac{1}{2}$ inch long, apex abruptly rounded into an apiculus.

P. rubra, Link. Shoot as in *P. nigra*, but the foliage yellowish-green in colour.²

B.—OUTER BUD SCALES NOT SUBULATE, AT MOST ONLY ACUMINATE.

* *Pubescence on the branchlets not confined to the grooves between the pulvini.*

P. Engelmanni, Engelmann. Branchlets grey with scattered white pubescence. Buds conic, obtuse, with scarious scales. Leaves, $\frac{3}{4}$ to 1 inch long, bluish, emitting a disagreeable odour when bruised.

P. excelsa, Link. Branchlets reddish,¹ with scattered hairs. Buds ovoid-conic, with obovate rounded scales, the lower keeled, acute and cuspidate. Leaves $\frac{1}{2}$ to $\frac{3}{4}$ inch long, with obtuse points.

P. obovata, Ledebour. Branchlets reddish-brown, with stiff, more or less dense pubescence. Buds ovoid with oval pubescent scales; the lower ones keeled and ending in long acuminate points. Leaves $\frac{1}{2}$ to $\frac{3}{4}$ inch long, with cartilaginous points.

P. orientalis, Carrière. Branchlets reddish-brown, densely pubescent with brown hairs. Buds conic, the lower scales pubescent, keeled, ending in long acuminate points. Leaves short, obtuse, $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

** *Pubescence on the branchlets confined to the grooves between the pulvini.*

P. Glehnii, Masters. Branchlets reddish-brown, with stiff shaggy hairs. Buds sub-globose, the outer scales thick and grooved, with cuspidate acuminate points. Leaves $\frac{1}{2}$ inch long, curved, with blunt points.

¹ In some specimens of *Picea excelsa* the shoots are quite glabrous.

² *P. rubra* and *P. nigra* are separated with difficulty in the absence of cones.



PICEA AJANENSIS.

PICEA AJANENSIS (*Fischer*).

Gardeners' Chronicle, Vol. XIII. p. 115 (1880), with fig.

" " " XIV. p. 427 (1880) "

Veitch's Man. Conif. ed. 2, p. 425 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 85 (1906).

A TREE which attains a height of 100 to 150 feet in its native localities, the main branches horizontal or ascending, forming a tree of broadly pyramidal outline. Bark of trunk greyish brown, fissuring into irregularly quadrangular scales. Branchlets shining, glabrous, yellow at first but becoming reddish-brown or grey in the second year.

Buds broadly conic, with ovate scales. Leaves persistent seven to nine years; flattened, thin, blunt, or ending in a short point, slightly keeled on both surfaces; ventral surface green without stomata; dorsal surface silvery-white with two broad bands of stomata.

Cones purple when young, brownish when mature, oblong, 2 to 3 inches long by about 1 inch in diameter; scales narrowly oblong-oval, denticulate in margin; bracts minute, concealed. Seed with a wing two or three times its length.

There are forests of this tree in Yezo where it attains its greatest development. It spreads northwards through Saghalien and the Kurile Islands, and occurs on the Continent through the coast district of Amurland to Ajan on the sea of Okhotsk. In Hondo, the main island of Japan, there occurs a form which Dr. Mayr has separated as a distinct species under the name of *Picea hondoensis*, but its characters do not appear to be at all well marked. *Picea ajanensis* was introduced into cultivation in 1861 by John Gould Veitch; and owing to a mixing of seeds was subsequently distributed under the name of *Abies Alcockiana*. According to Mayr all the older trees cultivated in Great Britain under the name of *Picea ajanensis* belong to *P. hondoensis*, and he asserts that the true Yezo spruce was not introduced into European cultivation until 1891.

The Bayfordbury specimen planted in 1879 is now 14 feet high. The cones photographed were grown at High Leigh, Hoddesdon.

PICEA ALBA (*Link*). WHITE SPRUCE.

Gardeners' Chronicle, Vol. XI. p. 884 (1879).

Veitch's Man. Conif. ed. 2, p. 427 (1900).

A TREE varying in height and habit according to its situation, attaining a height of 60 to 70 feet with a trunk 6 feet in girth, but reduced in its northern limit to a mere shrub. Bark thin, greyish-brown and scaly.

Branchlets whitish-brown, glabrous. Buds about $\frac{1}{4}$ inch long or less, with chestnut-brown scales. Leaves persistent four to five years, crowded on the upper side of the branchlets, spreading, pale green or glaucous, with an unpleasant smell when bruised, $\frac{1}{2}$ - 1 inch long, quadrangular in section, mucronate, with stomata on all four sides.

Cones sessile, cylindric, obtuse, $1\frac{1}{2}$ -2 inches long and $\frac{1}{2}$ - $\frac{3}{4}$ inch in diameter; scales loosely imbricated when mature, sub-orbicular, pale brown, very thin and flexible.

This spruce has a very wide distribution in North America extending as far as the northern tree limit, nearly to the Arctic Sea, and reaching Behring Strait in Alaska south of the Dominion boundary; it extends southwards to the New England states, New York, Michigan, Wisconsin and Dakota. According to Sargent the wood is light, soft and straight-grained, with a satiny surface.

Aiton states that *Picea alba* was introduced about the year 1700 when it was cultivated at Fulham by Bishop Compton.

The Bayfordbury specimen which has attained a height of 38 feet was planted in 1850.



PICEA ALBA.



PICEA ALCOCKIANA.

PICEA ALCOCKIANA (*Carrière*).

Gardeners' Chronicle Vol. XIII. p. 212 (1880).

Veitch's Man. Conif. ed. 2, p. 429 (1900).

A TREE attaining a height of 70 feet or more with greyish-brown scaly bark. Branches stout, horizontal or depressed.

Branchlets pale brown or almost white, pubescent. Buds ovoid with obtuse closely imbricated scales. Leaves persisting five to seven years, crowded, linear, quadrangular in section, mucronate, $\frac{1}{2}$ - $\frac{3}{4}$ inch long, with lines of stomata on the ventral surfaces, and broad white bands on the dorsal surfaces.

Cones ovoid-cylindric, 3-4 inches long and 1-1 $\frac{1}{4}$ inches in diameter when closed; scales broadly obovate-cuneate; seed-wing obovate-oblong, two-thirds as long as the scale.

Picea Alcockiana occurs only in the mountains of central Japan, where it was discovered on Fuji-Yama by John Gould Veitch in company with Sir Rutherford Alcock and introduced in 1861. It occurs at an altitude of 6,000 to 7,500 feet.

This tree was formerly confused with *Picea ajanensis* owing to seeds of the two species having been distributed under one name. It is extremely rare in cultivation.

Picea Alcockiana was added to the Bayfordbury collection in 1908. The cones photographed were obtained from a tree at Pencarrow, Cornwall.

PICEA BREWERIANA (*Watson*). BREWER'S SPRUCE.

Gardeners' Chronicle, Vol. XXV. p. 498 (1886), with fig.

Veitch's Man. Conif., ed. 2, p. 480 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 82 (1906).

A TREE attaining a height of 80 to 120 feet with a girth of 6 to 9 feet. Branchlets quite distinct in character, long, slender, whip-like, pendulous, 6 to 8 feet long and about $\frac{1}{4}$ inch in thickness.

Leaves radially arranged, about an inch long, linear, convex on both surfaces, obtuse or shortly pointed; ventral surface dark green and shining, with a prominent midrib; dorsal surface with lines of stomata. Bark grey, peeling off in small square scales and exposing the brown cortex below.

Cones oblong, narrowed at both ends, $2\frac{1}{2}$ - 5 inches long by $\frac{3}{4}$ - 1 inch in diameter, green when young, orange-brown when mature; scales broadly obovate with entire rounded margins; bract minute, concealed, oblong, denticulate in the upper margin. Seed with a wing three times its length.

Picea Breweriana, one of the rarest of American conifers, occurs only on northern slopes in small groves at an altitude of about 4,000 to 6,000 feet on the main divide of the Siskiyou Mountains between Oregon and California at the head waters of the Illinois River, also in a smaller grove at the head waters of the Josephine Creek, 40 miles north-west of the grove previously mentioned, and in two or three other localities. It was discovered by Thomas Howell in 1884. The local name is the Weeping Spruce.

A young specimen, two feet high, was planted at Bayfordbury in 1908. This and the small tree at Kew, which is about three feet high, are probably the only specimens in Great Britain.

The cone illustrated was collected by Mr. F. R. S. Balfour in 1907.



PICEA BREWERIANA.



PICEA ENGELMANNII

PICEA ENGELMANNI (*Engelmann*).

Gardeners' Chronicle, 1869, p. 1085.

Veitch's Man. Conif. ed. 2, p. 481 (1900).

A TREE attaining in America a height of 100 to 150 feet and a girth of 12 to 15 feet; branchlets slender, light brown; the young shoots paler in colour and pubescent. Bark in young trees smooth and silvery; scaly in old trees.

Buds conic, about an eighth of an inch long, with reddish-brown scales. Leaves persisting four to five years, quadrangular in section, with acute callous tips, $\frac{1}{2}$ - 1 inch long, pointing forwards, glaucous at first but becoming darker later. Cones ovoid-cylindric, about 2 inches long, and $\frac{3}{4}$ - 1 inch in diameter, light green tinged with crimson when fully grown, becoming afterwards shining brown; scales thin with toothed margins.

This spruce occurs at altitudes varying from 3,000 to 11,500 feet in the Rocky Mountains from Alberta and British Columbia to Arizona and New Mexico, and westward to the Cascade Mountains of Washington and Oregon, often forming pure forests. It was discovered on Pike's Peak in Colorado by Dr. C. C. Parry in 1862, and introduced a few years later. It is rare in cultivation.

Picea Engelmanni somewhat resembles *P. pungens*, the former having less prickly leaves, which when bruised emit a disagreeable odour. In its native habitats it sometimes fruits profusely when young, the leader being bent down with the weight of the cones.

The Bayfordbury specimen, planted in 1879, is 14 feet high. The cones photographed were obtained from the Arnold Arboretum, U.S.A.

PICEA EXCELSA (*Link*). NORWAY SPRUCE.

Veitch's Man. Conif. ed. 2, p. 482 (1900).

A TREE attaining a height of 100 to 150 feet and a girth of 9 to 15 feet. Bark thin, reddish-brown, exfoliating in thin scales. Branches short, persistent on the trunk for many years even in dense woods.

Branchlets rigid, reddish-brown or orange-red, glabrous, or with scattered pubescence. Buds ovoid-conic, about $\frac{1}{4}$ inch long, with rounded scales coriaceous in margin.

Leaves persistent for several years, those on the upper side of lateral branchlets more or less imbricate and pointing forwards; those below arranged in two lateral sets; quadrangular in section, mucronate, $\frac{1}{2}$ - $\frac{3}{4}$ inch long, green, with lines of stomata on all four sides. Leaves on leading shoots radially disposed on all sides.

Cones pendulous, cylindric, 4-7 inches long and 1-2 inches in diameter; scales sub-rhomboidal, truncate and toothed at the apex, light brown. Seeds $\frac{1}{8}$ inch long; wings $\frac{2}{3}$ inch long.

This spruce has a very wide geographical distribution in Europe, ranging from the Pyrenees in the west to the Ural Mountains in the east, and north to south from Lapland to the Alps of northern Italy and to the Rhodope mountains in Rumelia. It is extremely variable, especially under cultivation, and numerous varieties have been described. It is of great economic importance yielding a light and durable wood which is generally employed for all kinds of constructive purposes, large quantities being imported under the name of white deal. In Germany and Scandinavia a large quantity of the wood is converted into paper pulp.

Picea excelsa is known to have been in cultivation in Great Britain since 1548, and is one of the commonest and hardiest conifers.

There are two fine specimens at Bayfordbury measuring respectively 93 feet by 9 feet 2 inches and 95 feet by 12 feet 6 inches which were planted in 1838.



PICEA EXCELSA.

21⁰



PICEA GLEHNII.

PICEA GLEHNII (*Masters*).

Gardeners' Chronicle, Vol. XIII. p. 300 (1880).

Veitch's Man. Conif. ed. 2, p. 437 (1900).

A TREE attaining a height of 100 feet with reddish-brown bark, exfoliating in thin scales. Branchlets reddish, with a shaggy pubescence between the pulvini. Buds small, ovoid, surrounded by a row of long-pointed glabrous scales, a few of the basal scales in the terminal buds ending in long subulate points.

Leaves arranged as in the common spruce, $\frac{3}{8}$ - $1\frac{1}{2}$ inch long, ending in a short point, compressed, quadrangular in section, with stomata on all four sides. Cones cylindrical, $2\frac{1}{2}$ inches long, 1 inch in diameter, shining brown when ripe, with sub-orbicular scales, slightly denticulate on the upper margin, and minute bracts. Seed with wing $\frac{2}{5}$ inch long.

Picea Glehnii was discovered in 1861 in the island of Saghalien by Glehn the comrade of Schmidt on the latter's expedition, and subsequently in Yezo by Maries who sent seeds to Messrs. Veitch. It has since been found in Formosa. The wood is used by the natives for various kinds of carpentry.

A specimen was added to the Bayfordbury collection in 1907. The photograph represents a native specimen.

PICEA MORINDA (*Link*). WESTERN HIMALAYAN SPRUCE.PICEA SMITHIANA (*Boissier*).

Gardeners' Chronicle, Vol. XXIV. p. 393 (1885) with fig.

Veitch's Man. Conif. ed. 2, p. 454 (1900).

A TREE which attains a height of 200 feet and a girth of 20 feet. Bark brownish-grey and fissured. Branchlets pendulous, pale brown, glabrous.

Buds spindle-shaped, $\frac{1}{2}$ inch long, with reddish-brown scales. Leaves radially arranged on all the branchlets, $1\frac{1}{2}$ -2 inches long, tapering to a fine cartilaginous point, quadrangular in section, with lines of stomata on all four sides.

Cones cylindric, obtuse, 4-7 inches long, $1\frac{1}{2}$ -2 inches in diameter; scales smooth, shining, with rounded and entire upper margin. Seeds dark brown, with the wing $\frac{3}{4}$ inch long.

Picea Morinda, which was introduced into cultivation in 1818 by Dr. Gowan of Cupar, occurs in the western Himalayas from Afghanistan to Nepal. The timber which is white and very soft can only be used for inside work.

The date of planting at Bayfordbury is not known.



PICEA MORINDA.



PICEA NIGRA.

PICEA NIGRA (*Link*). BLACK SPRUCE.

Gardeners' Chronicle, Vol. XI. p. 334 (1879).

Veitch's Man. Conif. ed. 2, p. 488 (1900).

A TREE usually attaining in America a height of 30 feet with a trunk 3 feet in girth, but said occasionally to be much larger. Bark reddish-brown, exfoliating in irregularly shaped scales.

Branchlets pale or reddish-brown, densely pubescent with whitish hairs. Buds small, ovoid, with an outer ring of long subulate-pointed scales.

Leaves on lateral branches arranged as in the common spruce, $\frac{1}{2}$ inch long, greyish or bluish-green, straight or slightly curved, obtuse, with a cartilaginous apex, quadrangular in section, with lines of stomata on all four sides.

Cones ovoid, obtuse, about an inch long, green tinged with purple at first, becoming reddish-brown when ripe; scales broadly ovate or orbicular with denticulate margins. Seeds $\frac{1}{8}$ inch long with pale brown wings $\frac{1}{2}$ inch in length. The cones persist on the tree for several years after the dehiscence of the seeds.

Picea nigra occurs over nearly the whole of the Dominion of Canada, except British Columbia, crossing the Rocky Mountains into Alaska, and extending southwards in the United States to Pennsylvania, northern Virginia, Wisconsin and Michigan. It is common on barren hills, swampy ground and peat bogs. The wood is used for the manufacture of paper pulp.

Picea nigra was introduced into English cultivation about 1700 by Bishop Compton and is now fairly common in collections. The Bayfordbury specimen planted in 1842 was blown down and has since grown up from the roots attaining a height of 13 feet.

PICEA OBOVATA (*Ledebour*). SIBERIAN SPRUCE.

Veitch's Man. Conif. ed. 2, p. 441 (1900).

A TREE allied to the Norway Spruce and by some authorities considered a variety of it. It attains a height of 100 feet or more. Branchlets ashy-grey, with scattered minute glandular pubescence. Buds conic, about $\frac{1}{4}$ inch long, with chestnut-brown scales. Leaves similar to those of *P. excelsa*.

Cones 3-4 inches long, cylindrical, shining brown when ripe; scales with entire truncate margins. Seed $\frac{1}{2}$ inch long with narrow long wing.

Picea obovata occurs over a very wide area in north-east Russia and Siberia.

A young plant of the Siberian Spruce was added to the Bayfordbury collection in 1906.

The illustration represents a branch with cones brought from Siberia by Mr. C. F. H. Leslie in 1908. Seedlings were raised from these cones the same year.



PICEA OBOVATA.



PICEA OMORICA.

PICEA OMORIKA (*Bolle*). SERVIAN SPRUCE.

Gardeners' Chronicle, Vol. XXI. pp. 808, 809 (1884), with figs.

„ „ Vol. XXI. new series p. 153 (1897), with fig.

Veitch's Man. Conif. ed. 2, p. 442 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 78 (1906).

A tree with a slender trunk and spire-like crown, attaining in its native habitats a height of over 100 feet, with a girth of only about 4 feet. Bark of trunk reddish-brown, exfoliating in plate-like scales.

Branches short in proportion to the height of the trunk, the lower ones decurved but turning upwards at the ends, the upper ones horizontal or ascending. Branchlets brown, pubescent. Buds ovoid-conic with red-brown scales, the outermost of which end in long subulate points.

Leaves on vertical shoots radially arranged; on lateral shoots pointing forwards on the upper side; pseudo-distichous in three-four ranks on the under side, persisting about four years, flattened, $\frac{1}{2}$ to $\frac{3}{4}$ inch long, with a short tip, acute or obtuse, convex and shining green on the ventral surface, with a prominent midrib and lines of stomata on the dorsal surface.

Cones ovoid-conic, 2 inches long or more, bluish-black when young, becoming dark brown when ripe, horizontal or pendulous, with suborbicular convex scales. Seed small, about $\frac{1}{8}$ inch long, wing $\frac{1}{3}$ inch long.

Picea Omorika has a restricted distribution, being only known to occur on both sides of the valley of the river Drina, which forms the boundary between Servia and Bosnia. It was discovered there as recently as 1875 by Dr. Pancic, growing on limestone rocks at an elevation of 2,700 to 5,300 feet, and introduced into cultivation about 1884. It is quite hardy.

A young tree was added to the Bayfordbury collection in 1906. The photograph represents a specimen from one of the Kew trees which were raised from seed obtained from Belgrade in 1889.

PICEA ORIENTALIS (*Carrière*). ORIENTAL SPRUCE.

Gardeners' Chronicle, Vol. XXV. p. 833 (1886) with fig.

Veitch's Man. Conif. ed. 2, p. 443 (1900).

A TREE attaining in the Caucasus 180 feet in height and 12 feet in girth. Bark of trunk brown, eventually exfoliating in thin scales. Branchlets slender, pale brown, densely pubescent, with short wavy non-glandular hairs. Buds conic, acute, with obtuse chestnut-brown scales.

Leaves, arranged as in the common spruce, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, quadrangular in section, obtuse, with lines of stomata on all four sides, dark green and glossy.

Cones cylindric, pointed, 3 - 4 inches long, and $\frac{3}{4}$ inch in diameter, purple when growing, brown when ripe; scales obovate-oblong with entire margins. Seed small, blackish, with a long wing.

Picea orientalis occurs in the mountains of Asia Minor, Armenia, and the Caucasus at an altitude of 2,000 to 6,000 feet, and was discovered by Tournefort on the mountains south-east of Trebizond in 1717. It was introduced into Great Britain about 1837 and is now generally planted on account of its ornamental habit.

There is a good specimen at Bayfordbury 44 feet high, which was planted in 1838.



PICEA ORIENTALIS.

44



PICEA POLITA.

PICEA POLITA (*Carrière*).

Gardeners' Chronicle, Vol. XIII. p. 298 (1880).

Veitch's Man. Conif. ed. 2, p. 446 (1900).

A TREE attaining in Japan a height of 120 feet. Bark reddish-brown, scaly. Branchlets stout, yellowish-brown, shining, glabrous. Buds ovoid conic, about $\frac{1}{2}$ inch long, with ovate-obtuse reddish-brown scales. Leaves on lateral branchlets arranged as in the common spruce, $\frac{3}{4}$ inch long, very rigid, curved or falcate, ending in a spine-like cartilaginous point, quadrangular in section with four to six lines of stomata on each of the four sides.

Cones ellipsoid, 3-4 inches long, light reddish-brown; scales sub-orbicular, with the upper margin rounded and minutely denticulate; bracts minute, linear, oblong, entire, apparently obsolete in cultivated specimens. Seeds $\frac{1}{3}$ inch long with wings about $\frac{3}{4}$ inch long.

Picea polita occurs as a rare tree in the main island of Japan south of 38° latitude, and is always found in small groups or as isolated specimens in forests of broad-leaved trees. It is however much cultivated by the Japanese for decorative purposes. It was introduced into cultivation by John Gould Veitch in 1861.

There is a small specimen on the lawn at Bayfordbury which coned freely in 1907. It is about 15 feet high and was planted in 1879. In 1908 seedlings were raised from seeds of this tree.

PICEA PUNGENS (*Englemann*).

Gardener's Chronicle, Vol. XI. p. 884 (1879).

„ „ „ *X. series* 8, p. 547 (1891), with fig.

Veitch's Man. Conif. ed. 2, p. 448 (1900).

A TREE attaining in America a height of 80 to 100 feet or more, with a trunk rarely 9 feet in girth. Bark brownish-grey, fissuring into oblong plates. Branchlets stout, rigid, yellow-brown, glabrous. Buds ovoid or broadly conic, with chestnut-brown scales.

Leaves on lateral branches radially arranged, stout, rigid, $\frac{3}{4}$ - $1\frac{1}{4}$ inches long, quadrangular in section, sharp-pointed with lines of stomata on all four sides, more or less glaucous and varying in colour from bluish-grey to silvery-white.

Cones cylindrical, 2-4 inches long, light brown; scales undulate in margin and erose at the apex; bract much shorter than the scale, rhomboidal, acuminate, lacinate at the upper edge. Seeds $\frac{1}{8}$ inch long, half the length of their wings.

Picea pungens occurs in the region of the Rocky Mountains from Colorado and eastern Utah northwards to Wyoming, growing often on the banks of streams or rocky ledges at 6,000 to 10,000 feet elevation. It was discovered on Pike's Peak in Colorado in 1862 by Dr. Parry and shortly afterwards introduced into cultivation. The glaucous form is highly valued in gardens on account of its decorative character, although it does not attain to any size. The green-leaved form is somewhat rare.

The Bayfordbury specimen of the glaucous variety is about 12 feet high. The date of planting is unknown. The photograph represents a specimen from a tree growing in the Arnold Arboretum, U.S.A.



PICEA PUNGENS.



PICEA RUBRA

PICEA RUBRA (*Link*). RED SPRUCE.

Veitch's Man. Conif. ed. 2, p. 450 (1900).

A TREE attaining in its native localities a height of 70 to 80 feet with a girth of 6 to 9 feet.

Bark of trunk red-brown and scaly. Branches slender, spreading, often clothing the trunk to the ground, forming a tree of conical habit. Branchlets reddish-brown, with dense glandular pubescence. Buds ovoid-conic, with long, subulate points to the outer scales. Leaves crowded on the branchlets, more or less curved, quadrangular in section, with white lines of stomata on the four surfaces, $\frac{1}{2}$ - $\frac{3}{4}$ inch long.

Cones ovoid-cylindric, red-brown, tinged with purple, about $1\frac{1}{2}$ inches long and $\frac{3}{4}$ inch broad. Scales broadly obovate-cuneate with entire margins, slightly striate externally. Seed with a wing about three times its length.

Picea rubra is very closely allied to *P. nigra*, of which Michaux considered it a variety, and cannot be satisfactorily distinguished from that species in the absence of cones. It is a native of Nova Scotia, Prince Edward Island, and the valley of the Saint Lawrence and of the north-eastern United States, where it constitutes a most valuable timber tree.

The specimen of Red Spruce planted at Bayfordbury in 1847 is now dead. A young tree was added in 1907. The cones photographed were produced by a tree on Lord Walsingham's estate at Merton.

PICEA SCHRENKIANA (*Fischer* and *Meyer*).

Veitch's Man. Conif. ed. 2, p. 451 (1900).

A LARGE tree apparently attaining similar dimensions to *Picea obovata*. Branchlets ashy grey, glabrous or with a scattered short pubescence. Buds large, ovoid, with light brown, obtuse, ciliate scales.

Leaves on laterel branches in an imperfect radial arrangement, $\frac{3}{4}$ to $1\frac{1}{4}$ inches long, straight or curved, rigid, tipped in young trees with a long sharp cartilaginous point, obscurely quadrangular in section, with about three stomatic lines on each side.

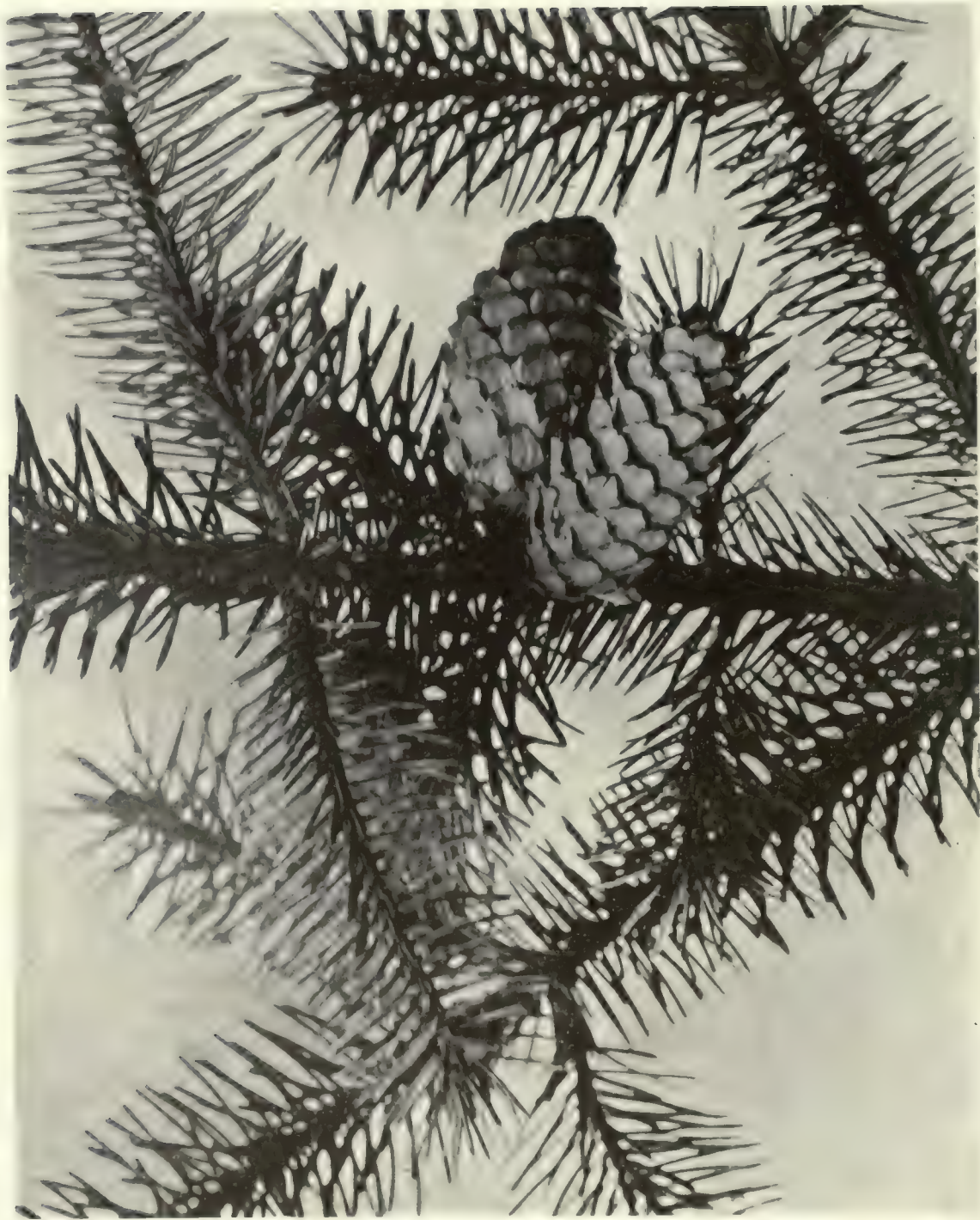
Cones cylindric, obtuse, 3-4 inches long and 1- $1\frac{1}{4}$ inches in diameter, dark, shining brown; scales obovate-cuneate with a truncate entire margin.

This species which was discovered in 1840 by Schrenk in Soongaria, forms large forests in Russian Turkestan, north of lat. 41° at 4,500 to 10,000 feet elevation and extends eastward through Chinese territory along the Tian-shan mountains.

A specimen was added to the Bayfordbury collection in 1907. The foliage illustrated is a specimen kindly sent by Mr. L. Späth of Berlin. The cone figured was collected in Turkestan by Dr. Regel and kindly lent by Messrs. Veitch.



PICEA SCHRENKIANA.



PICEA SITCHENSIS.

PICEA SITCHENSIS (*Carrière*). SITKA SPRUCE.

Veitch's Man. Conif. ed. 2, p. 452 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 92 (1906).

A TREE attaining in North America a height of 200 feet with a trunk 20 feet in diameter, tapering above the enlarged base. Cultivated trees have usually a broadly pyramidal outline. Bark with large, thin, red-brown scales. Branchlets yellow, shining, glabrous. Buds ovoid with obtuse scales.

Leaves on lateral branchlets arranged like *Picea ajanensis*, but narrower, linear, flattened, rigid, with sharp points, $\frac{1}{2}$ - $\frac{3}{4}$ inch long; deeply keeled on the ventral green surface and almost convex on the dorsal surface which has two broad white bands of stomata.

Cones shortly stalked, cylindrical-oval, obtuse, $2\frac{1}{4}$ to 4 inches long, by 1 to $1\frac{1}{2}$ inches wide, composed of oblong or oblong-oval scales which have denticulate margins; bracts lanceolate, about half as long as the scales. Seed with a wing three or four times its length.

Picea sitchensis extends farther north-west than any other North American conifer, being found in long. 151° west on the east end of Kadiak Island, and all through the coast region of Alaska and British Columbia, west Washington and Oregon, and as far south as Caspar in Mendocino Country, California. Being a distinctly moisture loving tree, it is never found more than 50 miles from the sea. It was discovered in Puget Sound by Archibald Menzies in 1792 but was not introduced into England until about 40 years later by Douglas. It is now common in cultivation. The timber is valuable and used for all constructive purposes.

The Bayfordbury specimen of *Picea sitchensis* was planted in 1840, and is now 61 feet high by 6 feet 6 inches in girth.

PICEA SPINULOSA (*Henry*).PICEA MORINDOIDES (*Rehder*). SIKKIM SPRUCE.*Gardeners' Chronicle*, Vol. XXXIX. pp. 132, 219 (1906).*Botanical Magazine*, Vol. 188, t. 8169 (1908).

A TREE attaining 80 feet in height. Branchlets glabrous, slender, yellowish when young but becoming grey with age. Buds ovoid, about $\frac{1}{4}$ inch long, pale brown, slightly resinous with obtuse scales.

Leaves in an imperfect radial arrangement, more crowded on the upper side of the branchlet, $\frac{3}{4}$ - $1\frac{1}{4}$ inches long, tipped at the apex with a sharp point, flattened, with two white bands of stomata on the upper surface, and green below.

Cones cylindric, obtuse, 2 - $3\frac{1}{2}$ inches long and about 1 inch in diameter, light brown, slightly lustrous; scales spathulate, obovate, $\frac{5}{8}$ inch long, with a finely serrate margin. Seeds $\frac{1}{5}$ inch long; wing $\frac{1}{2}$ inch long.

Picea morindoides was described by Rehder from a cultivated tree at Angers, France. It belongs to the flat-leaved section of *Picea* which includes *P. ajanensis* and *P. Omorika*. Its origin was at first unknown, but Dr. Henry's investigations have proved it to be a native of the eastern Himalayas, where it occurs sparingly in Sikkim, Bhotan and the Chumbi Valley, at elevations between 8,500 and 10,000 feet. It was discovered by Griffith on the Rodoli Mountain in Bhotan and named in 1847, *Abies spinulosa*. Very few specimens are known in cultivation.

The illustration represents a branchlet of a tree at Menabilly, Cornwall. Seedlings were raised from cones produced by this tree in 1908.



PICEA MORINDOIDES.

L A R I X.

DECIDUOUS, irregularly branched trees of pyramidal habit belonging to the tribe Abietineae of the natural order Coniferae. Branchlets producing both long and short shoots, the former with spirally arranged solitary leaves, the latter consisting of short spurs bearing clusters of leaves. The leaves are deciduous, linear, either flattened or keeled above and always strongly keeled beneath.

Flowers monœcious, produced by the short shoots. Staminate flowers always more numerous than the females, globose, ovoid or oblong, composed of shortly stalked stamens spirally arranged on a central axis and surrounded by bracts at the base. Female flowers erect, sub-globose, consisting of sub-orbicular imbricated scales, each in the axil of a longer mucronate bract, often very conspicuous by their bright pink or purple colour; they are however sometimes white. Cones ovoid, always erect, ripening in one season, composed of concave imbricated woody scales which are either shorter or longer than the bracts. Seeds two on each scale, winged.

The Larches resemble the Cedars in having clustered leaves, but in the latter these are evergreen. The cones differ much in the two genera.

About ten species of Larch have been described, natives of the colder regions of the northern hemisphere, often covering great areas and either forming pure forests or mixed with other conifers. They are found in Europe, Siberia, China, Japan, Kurile Islands, the Himalayas and North America. Nearly all the Larches furnish valuable timber.

KEY TO LARIX.

A.—LEAVES DEEPLY KEELED ON BOTH SURFACES.

Larix Lyallii, Parlatores. Young branches covered with a dense greyish tomentum which persists in part in the second year.

B.—LEAVES KEELED ONLY ON THE LOWER SURFACE, THE UPPER SURFACE BEING FLATTENED OR ROUNDED.

* *Young branchlets pubescent.*

† Leaves glaucous, bluish, with two conspicuous bands of stomata on the lower surface.

Larix leptolepis, Endlicher. Branchlets of the second year reddish, with a glaucous tinge. Leaves numerous in the bundle, long and slender, arranged in an erect, cone like pencil.

Larix kurilensis, Mayr. Branchlets of the second year shining, reddish-brown, pubescent, not glaucous. Leaves few in the bundle, short and very broad, spreading so as to form an open cup round the bud.

† † Leaves greenish, with two inconspicuous bands of stomata on the lower surface.

Larix Griffithii, Hooker. Branchlets of the second year very stout, dull reddish-brown; pubescent. Short shoots broad and fringed above by very large loose reflected pubescent membranous bud-scales.

Larix occidentalis, Nuttall. Branchlets of the second year slender, light brown, shining, pubescent. Short shoots slender, with a narrow conspicuous fringe of bud-scales.

Larix sibirica, Ledebour. Branchlets of the second year slender, shining, greyish-yellow, glabrous, the long hairs present in the furrows between the pulvini of the first year's shoot having fallen off. Leaves very long and slender, up to 2 inches in length.

* * *Young branchlets glabrous.*

† Branchlets yellowish-grey in colour.

Larix europæa, De Candolle. Branchlets of the second year shining, glabrous, yellowish-grey.

† † Branchlets brown in colour.

Larix americana, Michaux. Young branchlets often glaucous. Branchlets of the second year shining brown. Short shoots blackish. Leaves short, not exceeding $1\frac{1}{2}$ inches in length.

(1). In certain specimens of this species the branchlets are indistinguishable from those of *Larix europæa*, and in the absence of cones only show a difference in the leaves which are very long and slender in *L. sibirica*.

Larix dahurica, Turczaninow. Young branchlets never glaucous. Branchlets of the second year shining brown. Short shoots blackish. Leaves long, exceeding $1\frac{1}{2}$ inches in length.

These two species strongly resemble each other in technical characters, but are readily distinguished as seen in cultivation in this country by the appearance of the branchlets which in *L. dahurica* are vigorous, long and straight, whereas in *L. americana* which makes slow growth, they are short, curved and twisted.

Larix occidentalis, Nuttall, var. In glabrous specimens of this species the chestnut-brown short shoots will readily distinguish them from either of the two preceding species.



LARIX AMERICANA.

LARIX AMERICANA (*Michaux*). TAMARACK.

Veitch's Man. Conif. ed. 2, p. 889 (1900).

Trees of Great Britain and Ireland. Vol. II. p. 392 (1907).

A MEDIUM sized tree of pyramidal habit, attaining in America a height of 80 feet with a slender trunk about 6 feet in girth. Bark exfoliating in thin scales.

Branchlets slender, glabrous, sometimes glaucous, or sparingly pubescent in the grooves. Leaves short, light green in colour, not more than $1\frac{1}{4}$ inches long, flat or rounded above, strongly keeled beneath, with two bands of stomata.

Cones small, composed of three or four rows of spirally-arranged scales, carmine when young, reddish-brown when mature; scales longer than broad, about two-fifths of an inch long, shining, striated, the upper margin rounded and bevelled. Bract concealed, minute. Seed with a wing about $\frac{1}{3}$ inch long.

Larix americana is widely spread in the Dominion of Canada, occurring as far north as Labrador and the Arctic circle and extending westward to the Rocky Mountains. It also occurs in the northern part of the United States, through New England, New York, to Pennsylvania and West Virginia, and in Minnesota, Indiana and Illinois. It often grows in swamps. According to Loudon it was introduced by the Duke of Argyll in 1760. It seems to be rare in cultivation.

Young trees were added to the Bayfordbury collection in 1907 and are growing rapidly. The branch photographed was obtained from Dropmore where there is a well-grown specimen.

LARIX DAHURICA (*Turczaninow*). DAHURIAN LARCH.

Veitch's Man. Conif. ed. 2, p. 890 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 879 (1907).

A TREE which attains in Saghalien a maximum height of 150 feet, with a straight slender trunk and a more or less irregularly-branched crown. Bark exfoliating in thin plates. Branches and branchlets slender, glabrous, shining-brown in the second year. Leaves narrowly linear, about an inch long, pale green.

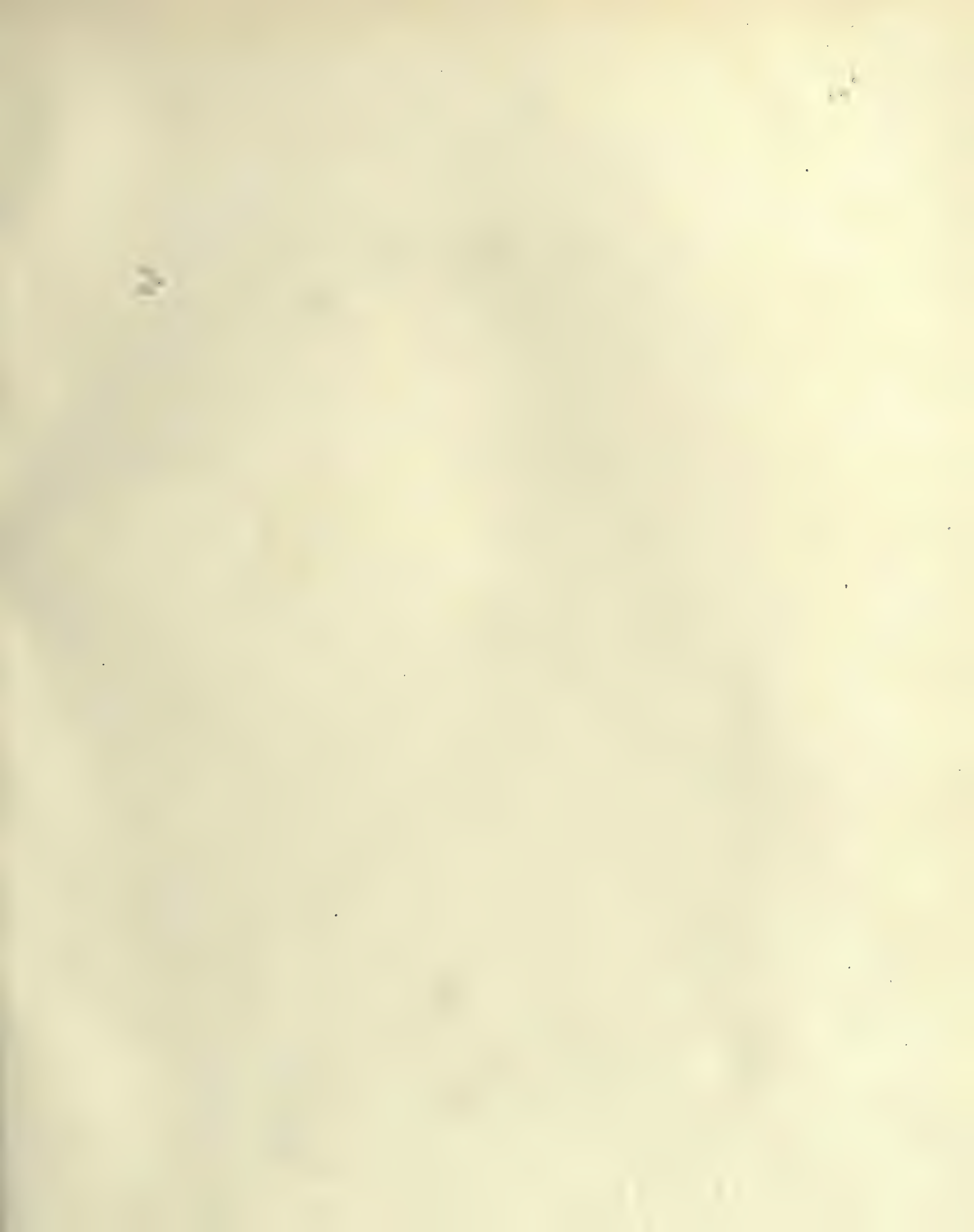
Cones variable in size, ovoid or sub-globose, $\frac{3}{4}$ - 1 inch long, composed of four to six rows of rounded or truncate bevelled scales which are longer than broad, about $\frac{1}{2}$ inch long, glabrous and shining light brown; bracts much shorter than the scales. Seed together with its wing nearly $\frac{1}{2}$ inch long.

This larch occurs in eastern Siberia, Manchuria, Korea and the island of Saghalien. It was first described by Aiton in 1789 under the name of *Pinus pendula* and was introduced in 1739.

There is a good specimen at Bayfordbury planted in 1840 which has attained a height of 56 feet and 5 feet in girth.



LARIX DAHURICA.





LARIX EUROPÆA.

LARIX EUROPÆA (*De Candolle*). COMMON LARCH.

Veitch's Man. Conif. ed. 2, p. 391 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 349 (1907).

A TREE 80 to 150 feet in height with a straight tapering trunk 10 to 15 feet in girth. Bark exfoliating in thin irregularly-shaped plates, becoming very thick in old trees. Branches spreading, more or less upturned at the ends.

Branchlets slender, glabrous, greyish yellow. Leaves light green, soft in texture, those on the terminal shoots shorter, broader and more acuminate than those in the tufts, the latter up to $1\frac{1}{2}$ inch long, obtuse ; upper surface flat or rounded ; lower surface keeled.

Cones ovoid-cylindric, but variable in size and shape, 1 - $1\frac{1}{4}$ inches long, composed of six to nine series of imbricated sub-orbicular pale-brown, pubescent scales, entire in margin ; bracts slightly exserted. Seed with a wing nearly as long as the scale.

Larix europæa, which is one of the commonest of conifers in cultivation, grows wild on the Alps, the mountains of Silesia and Moravia, Russian Poland and the Carpathians at altitudes from 1,300 to 8,000 feet. It attains its maximum elevation in the Dauphiné. The common larch is extensively planted on account of the valuable timber which it yields and the rapidity of its growth. The wood is very durable and suitable for general work on an estate, especially for gate-posts and fencing. It is not much used for constructive purposes as it is very liable to twist. The date of introduction into England is probably 1629 as it is mentioned as a very rare tree in Parkinson's *Paradisus* published in that year.

The best specimen at Bayfordbury planted in 1838 is 86 feet high with a girth of 8 feet 7 inches.

LARIX GRIFFITHII (*Hooker*). SIKKIM LARCH.

Gardeners' Chronicle, Vol. XXVI. p. 464 (1896), with fig.

Veitch's Man. Conif. ed. 2, p. 895 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 888 (1907).

A TREE 40 to 60 feet high with thick reddish-brown bark. Branches long and widely spreading, pendulous. Young branchlets stout, pubescent, reddish-brown. Leaves light-green up to $1\frac{1}{4}$ inches long; upper surface rounded or flat; lower surface deeply keeled with lines of stomata on both surfaces.

Cones cylindric, 3-4 inches long, tapering to a narrow apex, glaucous-green or purplish, with orange-brown bracts before ripening, composed of five spiral rows of scales which spread almost at right angles to the axis when mature; bracts exserted, lanceolate, cuspidate. Seed with wing seven-sixteenths inch long.

Larix Griffithii is a native of the Himalayas occupying a restricted area in eastern Nepal, Sikkim and western Bhotan at 8,000 to 12,000 feet elevation. It was discovered by Griffith in 1837. Although introduced in 1848 by Sir Joseph Hooker who sent seed to Kew, it has failed to grow in England except in the south-west where there are a few good specimens.

The cones figured were produced by a fine tree at Coldrenick, Cornwall. Seedlings from this tree were planted in Bell's Wood, Bayford, in 1907.



LARIX GRIFFITHII



LARIX KURILENSIS.

LARIX KURILENSIS (*Mayr*).

Trees of Great Britain and Ireland, Vol. II. p. 888 (1907).

A TREE attaining in its native habitats a height of 70 feet and a girth of 7 to 8 feet, with the bark resembling that of *Larix leptolepis*.

Young branchlets pubescent, those of the second year reddish-brown, lustrous. Leaves shorter than in the other species, falcate, about an inch long, glaucous, spreading so as to form an open cup round the bud; upper surface flattened, green; lower surface with two bands of stomata.

Cones small, cylindrical, about $\frac{3}{4}$ inch long, composed of less than twenty scales with the bracts visible at the base of the cone. Scales oval, longer than broad, about $\frac{1}{3}$ inch long; bract about half the length of the scale. Seed with wing $\frac{1}{3}$ inch long.

This tree was formerly considered a variety of *Larix dahurica* but has been separated as a distinct species by Mayr who found it in the Kurile Islands where it forms forests. It was introduced into cultivation in Europe by Dr. Mayr in 1888 and young trees are doing well in England.

Young specimens raised at Colesborne were added to the collection at Bayfordbury in 1908. The illustration is that of a native specimen collected by Mr. H. J. Elwes.

LARIX LEPTOLEPIS (*Endlicher*). JAPANESE LARCH.

Gardeners' Chronicle, Vol. XIX. p. 88 (1888), with fig.

Veitch's Man. Conif. ed. 2, p. 397 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 384 (1907).

A TREE 60 to 100 feet high, with wide-spreading branches, and a trunk occasionally 12 feet in girth. Bark reddish-brown, exfoliating in long strips.

Young branchlets glaucous, densely pubescent or sometimes almost without hairs, becoming reddish in the second year.

Leaves glaucous, about $1\frac{1}{4}$ inches long, obtuse at the apex; upper surface flattened; lower surface keeled; stomatic bands conspicuous, especially on the lower surface. Cones globose-conic, $1\frac{1}{4}$ inches long by about 1 inch broad, composed of four to five spiral rows of sub-orbicular scales, eight to nine in each row, with thin reflected upper margins. Seed wing about $\frac{2}{3}$ inch long.

Larix leptolepis occurs wild on the central mountains of Japan at 4,000 to 6,000 feet elevation. The timber is valuable for ship building, and is also used for railway sleepers and telegraph poles. This larch was first mentioned by Kaempfer in 1712. It was introduced into cultivation by J. G. Veitch in 1861. It has been largely planted of late years in the hope that it will become a profitable tree, as it is quite hardy, very fast in growth, and less subject to disease than the European Larch.

A young specimen was added to the Bayfordbury collection in 1907. The branch photographed is from a tree at Kew.



LARIX LEPTOLEPIS.



LARIX LYALLI.

LARIX LYALLII (*Parlatore*). LYALL'S LARCH.

Gardeners' Chronicle, Vol. XXV. p. 658 (1886), with fig.

Veitch's Man. Conif. ed. 2, p. 399 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 403 (1907).

AN alpine tree 40 to 80 feet high with a trunk occasionally 12 feet in girth. Bark of young stems thin and pale grey, fissuring when old into irregularly shaped scaly plates.

Young branchlets covered with a dense greyish woolly tomentum, which is retained on branchlets of the second year. Buds conspicuous from the long white matted hairs which fringe the margin of their scales.

Leaves keeled on both surfaces, rigid, pale blue-green, 1 - 1 $\frac{1}{4}$ inches long. Cones ovoid 1 $\frac{1}{2}$ - 2 inches long; scales numerous, loosely imbricated, thin, ovate, of a beautiful pink colour before ripening, $\frac{1}{2}$ inch long, fringed with matted hairs; bracts nearly as long as the scales with their slender points projecting. Seeds with pale pink wings.

Larix Lyallii was discovered by Dr. Lyall when surgeon and naturalist to the International Boundary Commission in British Columbia in 1858, who found it growing near the timber line at an elevation of nearly 7,000 feet in the Cascade Mountains. It has a somewhat restricted distribution, occurring on mountain slopes from 4,500 to 8,000 feet elevation in southern Alberta, British Columbia, northern Washington and Montana.

Young plants sent by Mr. F. R. S. Balfour were added to the Bayfordbury collection in 1908. The photograph is that of a native specimen collected by Dr. A. Henry in Montana.

LARIX OCCIDENTALIS (*Nuttall*). WESTERN LARCH.

Gardeners' Chronicle, Vol. XXV. p. 652 (1886), with fig.

Veitch's Man. Conif. ed. 2, p. 400 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 895 (1907).

A TALL tree which attains in America a height of 160 to 180 feet with a trunk sometimes 20 feet in girth. Bark dark brown becoming very thick and fissured in old specimens.

Young branchlets minutely pubescent, with long hairs in the grooves, shining brown in the second year. Leaves pale green up to $1\frac{3}{4}$ inches long, rounded on the back, keeled beneath, with lines of stomata on both surfaces.

Cones ovoid, obtuse, $1\frac{1}{4}$ to 2 inches long; scales sub-orbicular; bracts terminating in long bristle-like tips which are much longer than the scales. Seed wing $\frac{1}{4}$ inch long or more.

Larix occidentalis is confined to the wetter part of the region which extends from the western slope of the Rocky Mountains in British Columbia and Montana to the eastern slope of the Cascade Mountains in Washington and Oregon. It has a vertical range from 3,000 to 6,000 feet, where it is usually found mixed with other coniferous trees. It was discovered by Douglas on the upper Columbia river in 1826, but was only introduced into cultivation in 1881 when seedlings were sent to the Arnold Arboretum. It is very scarce in England only a few trees being known.

According to Professor Sargent the timber of the western larch is very valuable, being strong, durable and free of knots. It is used for general building purposes, and being straight grained and easily worked, is also employed for inside decoration, panelling and furniture.

Young plants raised at Colesborne were added to the Bayfordbury collection in 1906. The cones figured were grown at Kew.



LARIX OCCIDENTALIS.



LARIX SIBIRICA.

LARIX SIBIRICA (*Ledebour*). RUSSIAN LARCH.

Veitch's Man. Conif. ed. 2, p. 402 (1900).

Trees of Great Britain and Ireland, Vol. II. p. 374 (1907).

A TREE of narrowly pyramidal habit attaining in Siberia a height of over 100 feet with a trunk 9 to 12 feet in girth. Bark like that of the common Larch.

Young branchlets slender, pubescent or glabrous; those of the second year greyish-yellow, shining. Leaves soft in texture, very long and slender, up to 2 inches in length, narrower than in *L. europæa*, sharp pointed, deeply keeled on the lower surface, with stomata on both sides.

Cones ovoid-cylindric with the terminal scales not gaping, up to $1\frac{1}{2}$ inch long. Scales fewer than in *L. europæa*, convex from side to side and from their base to their apex; outer surface finely grooved, covered with a reddish-brown pubescence; bract ovate or oblong with a cuspidate point quite concealed. Seed wing shorter than the scale.

Larix sibirica is allied to the European Larch but differs in its leaves and cones. It is widely distributed in north-eastern Russia and Siberia.

This Larch was introduced by the Duke of Atholl in 1806 from Archangel but suffers so much from spring frost on account of the early opening of the buds that it is not likely to prove a success in this country and no specimens larger than nursery plants are known.

The timber which is very hard and durable is now imported in some quantity.

The Siberian Larch was added to the Bayfordbury Pinetum in 1908 and fifty young specimens were also planted in Bell's Wood, Bayford. The photograph represents a native specimen.

PSEUDOLARIX KAEMPFERI (*Gordon*). GOLDEN LARCH.

Gardeners' Chronicle, Vol. XXI. p. 584 (1884) with fig.

„ „ Vol. XLII. p. 844 (1907).

Veitch's Man. Conif. ed. 2, p. 403 (1900).

A HANDSOME tree, resembling a larch in appearance, attaining in eastern China a height of 120 to 130 feet with a trunk about 8 feet in circumference. Bark brown, fissured into irregularly shaped plates. Branches widely spreading.

Branchlets of two kinds, long shoots with solitary leaves spirally arranged, and short shoots or spurs bearing the leaves in tufts at their extremities. Leaves deciduous, green, but turning golden before falling, linear, acute $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long.

Male flowers in umbels at the tips of the lateral spurs, stalked, each consisting of about 20 anthers. Cones ovoid, 2 inches long, with deciduous scales, diverging at their apex, obtuse or notched at the tip, each with a minute bract. Seeds two on each scale with wings equalling the scale in length.

This conifer is a native of China where Fortune discovered it in the province of Chekiang and sent seeds to England in 1853. It is also recorded from Kiangsi by Franchet and Wilson. It is rare both as a wild tree and in cultivation, and is much valued as an ornamental tree on account of its handsome foliage. A specimen was planted at Bayfordbury in 1908.

The illustration represents foliage and young cones from a tree at Coombe Wood. The mature cone, collected by Maries, was kindly lent by Messrs. Veitch.



PSEUDOLARIX KÆMPFERI.



SEQUOIA GIGANTEA.

SEQUOIA GIGANTEA (*Decaisne*). WELLINGTONIA.

Gardeners' Chronicle, pp. 820, 823 (1853).

„ „ Vol. XIX. p. 556 (1896) with fig.

Veitch's Man. Conif. ed. 2, p. 274 (1900).

Trees of Great Britain and Ireland, Vol. III. p. 699 (1908).

A TREE which attains a height of over 300 feet with a tapering trunk which is occasionally 90 feet in girth above the enlarged and buttressed base. Young trees narrowly pyramidal. Old trees free of branches to 100 or 150 feet with an irregular crown. Bark 1 to 2 feet thick, divided into broad lobes, separating into loose reddish fibrous scales. Branchlets pendulous, dense, green at first, but becoming brown later. Buds minute without scales.

Leaves persistent for four years, approximately three ranked; on the main axes, ovate, acuminate, up to $\frac{1}{2}$ inch long; on the lateral axes, lanceolate, acute, $\frac{1}{8}$ to $\frac{1}{4}$ inch long; appressed and decurrent at the base, free and spreading in their upper half, rigid, ending in sharp cartilaginous points; lower surface green, rounded or keeled; upper surface with green midrib and two inconspicuous bands of stomata.

Cones ripening in the second year, ovoid-oblong, 2 to 3 inches long by $1\frac{1}{2}$ to 2 inches wide, brownish; scales gradually thickening from the base to the dilated disc, which is $\frac{3}{4}$ to 1 inch broad and often bears a reflexed spine in the centre of the transverse depression. Seeds $\frac{1}{8}$ to $\frac{1}{4}$ inch long, winged.

Sequoia gigantea is confined to the western slopes of the Sierra Nevada of California where it occurs in an interrupted belt at an elevation of 5,000 to 8,400 feet above sea-level. It was discovered by John Bidwell in 1841 and introduced by J. D. Matthew who visited the Calaveras Grove in 1853. It is now general in cultivation. The wood is light, soft and very brittle, and is used for shingles, box-making, etc, locally, but is not exported.

The Bayfordbury specimen was planted in 1850 and now measures 94 feet in height with a girth of 12 feet.

SEQUOIA SEMPERVIRENS (*Endlicher*). REDWOOD.

Gardeners' Chronicle, Vol. XIX. p. 556 (1896) with fig.

Veitch's Man. Conif. ed. 2, p. 270 (1900).

Trees of Great Britain and Ireland, Vol. III. p. 688 (1908).

A TREE attaining a height of over 300 feet with a slightly tapering and irregular lobed trunk, which is sometimes 50 to 75 feet in girth above the enlarged base. Bark 6 to 12 inches thick, divided into rounded ridges two or three feet in width, separating on the surface into long narrow fibrous scales which on falling display the reddish-brown spongy middle bark.

Young trees pyramidal with slender branches to near the base; older trees with stout horizontal branches above, forming an irregular narrow crown. Branchlets slender, green at first, becoming brownish later, spreading in two ranks. Buds small, with ovate, acute scales which persist dry and brown at the base of the branchlets.

Leaves on lateral branchlets spreading in one plane in two ranks by a twist on their bases, $\frac{1}{4}$ to $\frac{3}{4}$ inch long, linear or lanceolate, ending in short cartilaginous points, narrowed at the base, decurrent; upper surface dark green, furrowed; lower surface with a green midrib and two whitish stomatic bands. Leaves on leading branchlets radially arranged, about $\frac{1}{4}$ inch long, ovate or ovate-oblong, incurved.

Male flowers terminal or axillary, surrounded, at the base by ovate, acute, imbricated bracts. Cones ellipsoidal, $\frac{3}{4}$ to 1 inch long by $\frac{1}{2}$ inch broad, ripening in one year; scales with slender stalks which enlarge abruptly into discs $\frac{1}{4}$ inch in breadth. Seeds light brown, winged, one-sixteenth inch long.

This tree is found in a wild state on the western slopes, valleys and alluvial flats of the coast range from the Chetco river in Oregon, to twelve miles south of Punta Gorda in Monterey Country, California, occupying a narrow strip of country along the sea-coast, and extending inland only a few miles. It ascends from sea-level to 2,000 or rarely 3,000 feet.

It was introduced into England in 1863, and only thrives well on the south and west coast of Great Britain and in Ireland. In its native country the timber of the Redwood is largely employed for building and a variety of other purposes.

The specimens at Bayfordbury were planted in 1850, the largest tree measuring 74 feet by 10 feet 2 inches.



SEQUOIA SEMPERVIRENS.

12



SCIADOPITYS VERTICILLATA.

SCIADOPITYS VERTICILLATA (*Siebold and Zuccarini*).

UMBRELLA PINE.

Botanical Magazine t. 8050 (1905).

Veitch's Man. Conif. ed. 2, p. 287 (1900).

Trees of Great Britain and Ireland, Vol. III. p. 568 (1908).

AN evergreen tree attaining in Japan a height of 120 feet and a girth of 12 feet. Bark reddish-brown, scaling off in long strips. Branches sub-verticillate. Branchlets brown, glabrous, bearing minute, membranous, ovate-lanceolate scales which are spirally arranged and represent true leaves.

At the apex of the shoot there is a ring of similar scales, from the axils of which arise a whorl of leaf-like shoots, ten to thirty in number and acting the part of true leaves, 2 to 5 inches long, linear, rigid, spreading, dark green and glossy above, paler beneath, grooved on both surfaces.

Male flowers in dense heads at the apex of short branchlets; $\frac{3}{8}$ inch long, sub-sessile, with numerous spirally arranged, shortly stalked anthers. Cones borne on short stout stalks, clothed with a few membranous bracts, either remaining terminal and erect or pushed aside by the growth of a lateral branch; ripening in two years and persisting on the tree for some months after the seeds escape; 3 inches long, composed of woody fan-shaped scales with an irregular ridge on their convex outer surfaces. Seeds five to nine on each scale, oval, surrounded by a narrow wing.

This interesting tree is a native of Japan, and according to Shirasawa grows wild in mixture with *Abies firma* and *Cupressus pisifera* at 600 to 5,000 feet elevation in the forests of Kiso and Shinano. It is known in Japan as "Koyamaki."

Seeds of *Sciadopitys verticillata* were first sent to England in 1861. It is of very slow growth and only small specimens are known in England. The wood is soft and used in Japan for boat-building and making casks.

There is a specimen in the garden at Bayfordbury which has attained a height of 10 feet and coned freely in 1908.

The cone figured was gathered from a small tree at Pencarrow, Cornwall.

LIBOCEDRUS DECURRENS (*Torrey*). INCENSE CEDAR.LIBOCEDRUS CRAIGANA (*Henry*).

Veitch's Man. Conif. ed. 2, p. 258 (1900).

Trees of Great Britain and Ireland, Vol. III. p. 489 (1908).

A TREE attaining in America 180 feet in height and 21 feet in girth with a straight tapering trunk. Bark nearly an inch thick, light cinnamon-red, irregularly fissuring into scaly ridges. Cultivated trees in Great Britain assume a columnar habit with short ascending branches, the trunk being covered with reddish-brown bark which peels off in long strips. Branchlets covered with leaves and forming frondose expansions as in a *Thuya*.

Leaves scale-like, dark glossy green, each set of four equal in length, adnate for most of the length to the branchlets, but free at the tips which end in fine cartilaginous points, about $\frac{1}{8}$ inch long on secondary and tertiary axes, and $\frac{1}{2}$ inch long on main axes.

Flowers monœcious. Male flowers oblong, $\frac{1}{4}$ inch long, with about twelve to sixteen stamens, decussately opposite on a slender axis.

Cones pendulous, about one inch long, reddish-brown when mature, consisting of six scales. Seeds in pairs at the base of the two larger scales, each with two wings, one short, the other nearly as long as the scale.

Libocedrus decurrens was discovered by Colonel Fremont near the upper waters of the Sacramento river in 1846, and introduced into Great Britain by Jeffrey in 1853 as *Thuya Craigana*. This tree is widely distributed at altitudes of 3,000 to 7,500 feet over the western slopes of the Cascade and Sierra Nevada Mountains, the Californian coast ranges from Mendocino country to the San Bernardino Mountains, and is found also on mount San Pedro Martin in Lower California. It usually grows singly or in small groves. According to Sargent the wood is light and durable and is used for furniture and indoor carpentry.

The best specimen at Bayfordbury, which fruited freely in 1907, is 52 feet high by 5 feet 9 inches in girth. The date of planting is not recorded.



LIBOCEDRUS DECURRENS.

66



CUNNINGHAMIA SINENSIS.

CUNNINGHAMIA SINENSIS (*R. Brown*).

Veitch's Man. Conif. ed. 2, p. 292 (1900).

Trees of Great Britain and Ireland, Vol. III, p. 494 (1908).

AN evergreen tree attaining in China 150 feet in height and 18 feet in girth. Bark brownish, scaling off in irregular longitudinal plates. Branches at first in false whorls, afterwards given off irregularly. Young branchlets sub-opposite or in false whorls.

Leaves densely and spirally arranged on the branchlets, but twisted on their bases and thrown into two lateral spreading ranks; narrowed at the base and decurrent on the shoot to the insertion of the next leaf; rigid, more or less curved, narrowly lanceolate, acuminate, 1 to 2 inches long; upper surface dark green, concave; lower surface convex with a green midrib and two white stomatic bands; sharply and finely serrate.

Staminate flowers five to ten in an umbel at the apex of a branchlet, the umbel surrounded at its base by numerous triangular imbricated bracts; each flower cylindrical, composed of spirally crowded stamens. Fruit an ovoid-globose brownish cone, about $1\frac{1}{2}$ inches long, composed of thin woody loosely-imbricated broadly ovate or reniform scales with a cuspidate apex. Seeds three on each scale about $\frac{1}{4}$ inch long, brown, oblong, compressed, surrounded by a membranous narrow wing.

Cunninghamia was discovered in the year 1701 by J. Cunningham in the island of Chusan. This tree which has been known to the Chinese from the most ancient times is widely spread throughout the central, western and southern provinces of China. The timber is used for building purposes and making tea-chests.

Cunninghamia was introduced by William Kerr from Canton into Kew Gardens in 1804, but no trees of that date are now known to exist there. There is a small specimen at Bayfordbury which does not thrive, being invariably cut by spring frost.

The specimen illustrated is from a fine tree at Bicton in Devonshire.

ARAUCARIA IMBRICATA (*Pavon*). CHILE PINE.

Veitch's Man. Conif. ed. 2, p. 297 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 44 (1906).

AN evergreen tree attaining 100 feet in height with a cylindrical trunk 9 to 15 feet in girth. Bark rough, separating into irregular shaped scales.

Leaves spirally crowded on the branches, sessile, coriaceous, rigid, ovate, lanceolate, sharply pointed, slightly concave on the upper surface, glabrous, bright shining green, with stomata on both surfaces, persistent for 10 to 15 years.

Flowers usually diœcious. Male catkins cylindrical, solitary or clustered, terminal, sessile, erect, 3 to 5 inches long, yellow, composed of densely packed anther scales with recurved tips. Cones globular, brown in colour, 4 to 6 inches in diameter, falling to pieces when mature, ripening in two years. Seed one on each scale adnate to it, and falling with it, 1 to 1½ inches long, wingless, with a thick brown coat.

Native forests of this remarkable conifer occur in southern Chile where it attains its greatest development in a region known as the Sierra de Pemehue, a range of mountains lying on the west side of the upper course of the great Biobio river. It was discovered about 1780 by Don Francisco Dendariarena.

The Chile Pine is one of the best known and most generally distributed conifers in cultivation and there are many fine specimens in the British Isles.

The seeds are largely eaten by Araucanos and other tribes of Indians, and a gum which exudes from the bark is used in Chile as a salve for wounds. The timber has no commercial value and is only used locally.

The tallest Araucaria at Bayfordbury was planted in 1841 and now measures 30 feet in height.



ARAUCARIA IMBRICATA.



CRYPTOMERIA JAPONICA.

CRYPTOMERIA JAPONICA (*Don*).

Veitch's Man. Conif. ed. 2, p. 263 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 128 (1906).

AN evergreen tree attaining in China and Japan a height of 150 feet or more with a girth of 20 to 25 feet. Bark reddish-brown, exfoliating in long ribbon-like shreds. Leaves persistent for four or five years, spirally arranged on the shoots, curving inwards and directed forwards, awl-shaped, compressed, keeled on front and back, with stomata on both surfaces, with the base decurrent on the branchlet.

Male flowers clustered at the ends of the branchlets in false racemes.

Cones globular, brownish, ripening in the first year but persisting on the tree after the seeds have escaped; scales twenty to thirty, peltate, stalked, with sharp-pointed rigid processes. Seeds two to five on each scale, three-sided, narrowly winged.

This conifer was discovered in China in 1701 by J. Cunningham who found it in the island of Chusan, off the coast of Chekiang, and was discovered in Japan about 1692 by Kaempfer. In the latter country it is a most important tree from an economic as well as an ornamental point of view; it occurs wild in extensive forests and is also largely planted. The wood is used for a great variety of purposes, especially for building.

It was introduced into England by Captain Sir Everard Home, who sent seeds from Chusan in 1842. The Bayfordbury specimen is now 30 feet in height.

TAXODIUM DISTICHUM (*Richard*). DECIDUOUS CYPRESS.

Veitch's Man. Conif. ed. 2. p. 173 (1900).

Trees of Great Britain and Ireland, Vol. I. p. 173 (1906).

A DECIDUOUS tree known to attain 150 feet in height and 12 feet in diameter, trunk tapering, enlarged at the base; pyramidal when young, the crown becoming wide and flattened in older specimens. Bark dull reddish-brown, 1 to 2 inches thick, separating into long fibrous scales.

Branchlets of two kinds, those at the apex of the shoot persistent and bearing axillary buds; those lower on the shoot deciduous and without buds.

Leaves of a delicate green colour but turning a reddish-brown before they fall in autumn; inserted spirally on the branchlets, those on the persistent shoots spreading radially; those on the deciduous shoots thrown by a twisting of their bases into a pectinate arrangement, linear, acute, grooved above, keeled and bearing stomata below. In var. *imbricaria*, occurring both in the wild state and in cultivation. the leaves are appressed around the twig with their apices free and spreading.

Male flowers in panicles 3 to 5 inches long, arising at the end of the previous year's shoot; minute, consisting of a stalk surrounded at its base by ovate scales, and bearing six to eight stamens. Fruit a globular or ellipsoidal short stalked woody cone an inch or more in diameter, ripening in the first year, composed of thick coriaceous peltate scales. Seeds, two on each fertile scale, erect, three-angled.

The Deciduous Cypress occurs in the United States from southern Delaware along the coast region as far as the Devil's River in Texas, and up the Mississippi valley as far as southern Illinois and south-western Indiana. In these regions it inhabits alluvial tracts and swamps.

It was introduced into cultivation in England by John Tradescant about 1640. The wood is light and soft, and having the property of resisting damp is used for shingles, doors, sashes and greenhouses. It grows well in the southern and western counties of the British Isles.

The Bayfordbury specimen measures 25 feet in height.



TAXODIUM DISTICHUM.



1



2



3



4

1 THUYA OCCIDENTALIS.

2. THUYA ORIENTALIS.

3 THUYA PLICATA.

4 THUYA JAPONICA.

T H U Y A.

EVERGREEN trees of pyramidal habit belonging to the tribe Cupressineae of the order Coniferae. Branches spreading, terminating in flattened pinnately divided "branch systems" which are densely clothed with scale-like leaves. The leaves are arranged in four ranks, in two decussate pairs, those of the lateral ranks being boat-shaped, the dorsal and ventral ones flattened. In the seedling state the foliage is acicular and spreading.

Flowers monœcious, all solitary and terminal on the ultimate short branchlets of the previous year, the males consisting of three to six pairs of decussately arranged stamens. Cones solitary, composed of six to twelve imbricated scales in decussate pairs, the larger pairs only fertile and bearing two to five seeds at the base.

The Thuyas resemble the flat-leaved cypresses in habit and foliage. The latter are best distinguished by their fruit which consists of peltate and not imbricated scales. In the determination of the species the arrangements of the branch systems give good marks of distinction. In *Thuya orientalis* the branchlets stand in vertical planes; in the three other species they are arranged in horizontal planes. The leaves on the main axes also afford useful distinguishing characters. They differ as follows:—

1.—*Thuya plicata*, D. Don, North America. Leaves widely spaced, long, ending in long, fine, free points which are parallel to the axis; glands inconspicuous or absent. Under surface of the foliage usually marked with white streaks.

2.—*Thuya japonica*, Maximowicz, Japan. Leaves closely arranged. Shoots ending in short, rigid, thick, triangular points, directed outwards at an acute angle; glands absent. Under surface of the foliage conspicuously marked with broad white streaks.

3.—*Thuya occidentalis*, Linnaeus, North America. Leaves widely spaced, ending in long, fine points which are parallel to the axis; glands raised, large and conspicuous on the flat leaves. Under surface of the foliage pale green; white streaks inconspicuous or absent.

4.—*Thuya orientalis*, Linnaeus, China. Leaves widely spaced, ending in short, triangular, free points which are not rigid and are directed slightly outwards at an acute angle; flat leaves marked by longitudinal glandular depressions. Under surface of the foliage pale green without white streaks.

CUPRESSUS.

EVERGREEN trees belonging to the tribe Cupressineae of the order Coniferae. Branchlets 4-angled, flattened or rounded, on adult plants covered with minute scale-like, appressed leaves, either (a) uniform in four ranks, or (b) of two kinds, the back and front pair flattened, the lateral pair conduplicate. The leaves on young plants are spreading and acicular. Flowers monœcious, terminal, solitary. Staminate flowers cylindrical with the stamens arranged in decussate pairs. Female cones composed of four to ten peltate scales each bearing two or more seeds.

About fifteen species of Cupressus have been described; natives of the Levant, Himalaya, China, Japan and North America.

1. *CUPRESSUS MACROCARPA*.

2. *CUPRESSUS GOVENIANA*.

3 *CUPRESSUS SEMPERVIRENS*





1. *CUPRESSUS NOOTKATENSIS.*

2. *CUPRESSUS THYOIDES.*

3. *CUPRESSUS LAWSONIANA.*

KEY TO CUPRESSUS.

I.—*Eu. Cupressus*. Branchlets in two rows or in four irregular rows. Cones large, usually $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter, attaining maturity in the second year. Seeds five to ten under each scale.

Cupressus macrocarpa, Hartweg; California. Branchlets with the tips spreading, stout. Leaves $\frac{1}{4}$ to $\frac{1}{2}$ inch long. Cones 1 to $1\frac{1}{2}$ inches in diameter, dark reddish-brown. Umbo often with decurrent horse-shoe like margin. Seeds $\frac{1}{2}$ inch in diameter.

Cupressus sempervirens, Linnaeus; Levant. Branchlets slender. Leaves $\frac{1}{4}$ to $\frac{1}{2}$ inch long, closely appressed. Cones about 1 inch in diameter, light brown. Umbo bluntly conical not decurrent at the margins. Seeds $\frac{1}{2}$ inch in diameter.

Cupressus Goveniana, Gordon; California. Branchlets slender. Leaves $\frac{1}{4}$ to $\frac{1}{2}$ inch long. Cones $\frac{1}{2}$ inch in diameter. Umbo forming a mucro or short hook. Seeds $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter.

II.—*Chamaecyparis*. Branchlets always in two rows, the leaves of the lateral pair flattened, of the front and back pair conduplicate. Cones small, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, ripening the first year. Seeds two to five under each scale.

A.—LATERAL LEAVES ON THE OLDER BRANCHLETS LONGER THAN THE DORSI-VENTRAL LEAVES.

Cupressus Lawsoniana, A. Murray; Oregon and N. California. Margin of leaves indistinctly white or uniformly green below.

B.—LATERAL LEAVES ON OLDER BRANCHLETS NOT LONGER THAN THE DORSI-VENTRAL LEAVES.

Cupressus nootkatensis, Lambert; Alaska, British Columbia, Washington, Oregon. Branchlets horizontal or drooping, ultimate division four-angled. Leaves acute or sub-acute, not glandular. Cones often glaucous. Umbo scales prominent. The foliage emits a disagreeable odour when rubbed.

Cupressus thyoides, Linnaeus; Eastern United States. Branchlets erect, ultimate divisions fan-like compressed. Leaves acute, glandular on the back. Cones glaucous when young; umbos of the scales obscure.

JUNIPERUS.

EVERGREEN trees and shrubs belonging to the tribe Cupressineae of the order Coniferae. Leaves either all acicular and in whorls of three, or acicular on young plants and opposite or in threes and scale-like on older specimens, the two kinds of foliage often occurring on the same tree. Flowers diœcious, rarely monœcious; staminate flowers consisting of numerous anthers united into an ovoid or oblong catkin; pistillate greenish, minute, globular, with two to six bracts, each bearing one or two ovules. Fruit a berry-like cone containing one or more seeds.

Juniperus is closely allied to Cupressus, but is distinguished by its succulent fruit. Barren specimens are often difficult to identify, but many species are known by their dimorphic foliage, both acicular and scale-like leaves nearly always being present in the same specimen.

About thirty-five species of Juniper are known, distributed throughout the greater part of the northern hemisphere, extending from the Arctic Circle southward in America to Mexico and the West Indies, and in the Old World to the Azores, Canary Islands, Morocco, Algeria, Abyssinia, east tropical Africa, Asia Minor, Himalayas, China and Japan.

1. JUNIPERUS RECURVA. 2. JUNIPERUS CHINENSIS. 3 JUNIPERUS EXCELSA. 4 JUNIPERUS VIRGINIANA.



KEY TO JUNIPERUS.

A.—LEAVES IN THREES, LANCEOLATE, SHORT, LOOSELY APPRESSED. FRUIT OBLONG.

Juniperus recurva, Hamilton; Himalaya. Small tree with spreading and drooping branches; leaves linear-lanceolate, pointed, greyish or glaucous-green with a whitish band above. Fruit about $\frac{1}{2}$ inch long, one-seeded.

B.—LEAVES MOSTLY OPPOSITE AND SCALE-LIKE, OR OF TWO KINDS, NEEDLE-SHAPED AND SCALE-LIKE ON THE SAME PLANT.

* Scale leaves obtuse.

Juniperus chinensis, Linnaeus; China, Japan. Tree with rather slender branches. Scale-leaves rhombic-obtuse; fruit globular or top-shaped, often conspicuously glaucous, $\frac{1}{2}$ - $\frac{3}{4}$ inch across, with two or three seeds.

** Scale leaves acute.

Juniperus virginiana, Linnaeus; Canada, Rocky Mountains. Tree with conical head and spreading or upright branches. Scale-leaves acute or sub-acute, about $\frac{1}{8}$ inch long. Fruit up to $\frac{1}{4}$ inch in diameter, globular or ovoid; often very glaucous.

Juniperus excelsa, Bieberstein; Western Asia. Tree with pyramidal head and upright or spreading branches. Scale-leaves about $\frac{1}{8}$ inch long. Fruit bluish-black, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter.

GLOSSARY.

- Acuminate**, with a tapering point.
Adnate, attached the whole length.
Apiculate, furnished with a short sharp point.
Apophysis, the swollen upper part of the cone scale.
Appressed, pressed close against the surface of some other part.
Bifid, divided into two at the apex.
Bract-scale, in Coniferae a scale of the cone above which lies the seed-bearing scale.
Callous, hard and thick in texture.
Cartilaginous, hard and tough.
Ciliate, fringed with hairs.
Coriaceous, leathery.
Cortex, the bark or rind.
Cuneate, wedge shaped.
Cuspidate, suddenly contracted into a point.
Decurrent, prolonged downwards beyond the insertion.
Decussate, arranged in pairs alternately at right angles.
Dehiscent, splitting into definite parts.
Denticulate, minutely toothed.
Distichous, disposed in two vertical ranks.
Ellipsoid, shaped like an ellipse.
Emarginate, notched at the apex.
Entire, without toothing.
Erode, as though bitten or gnawed.
Exserted, protruding beyond.
Falcate, sickle-shaped.
Fascicle, a close cluster or bundle.
Filament, a thread-like body.
Filiform, thread-shaped.
Fimbriate, fringed.
Frondose, frond-like.
Fusiform, spindle-shaped.
Glabrous, without hairs.
Globose, nearly spherical.
Hilum, the scar left on the seed where formerly attached to the funicle or placenta.
Imbricated, overlapping.
Keeled, with a ridge like the keel of a boat.
Laciniate, cut into narrow lobes.
Lanceolate, broadest at or near the middle and tapering to each end.
Mucro, a sharp short terminal point.
Mucronate, tipped with a sharp point.
Obovate, reversed ovate, the distal end the broader.
Obtuse, blunt or rounded at the end.

Orbicular, circular in outline.

Ovoid, egg-shaped, with the broad part at the basal end.

Pectinate, with narrow segments set close like the teeth of a comb.

Peduncled, stalked.

Peltate, target shaped.

Pubescent, clothed with hair or down.

Pulvinus, an enlargement close under the insertion of a leaf.

Reniform, kidney shaped.

Recurved,
Reflexed, } turned downward or backwards.

Resin canal,
Resin duct,
Resin vesicle, } an intercellular passage containing resin.

Serrate, beset with teeth on the margin, directed towards the point.

Serrulate, serrate but with minute teeth.

Sessile, without a stalk.

Spathulate, spoon-shaped.

Stomata, minute pores, often forming white lines on the leaf surfaces.

Striate, finely grooved.

Subulate, awl-shaped.

Terete, circular in transverse section.

Ternate, in threes.

Tomentose, densely pubescent with matted wool or short hairs.

Truncate, as though cut off at the end.

Turbinate, top-shaped.

Umbel, umbrella shaped.

Umbo, the raised centre of the apophysis, or the thickened apex of the cone scale.

Undulate, wavy.

Whorl, an arrangement of branches or cones in a circle round an axis.

The pubescence of the branchlets and the serrations of the leaves can be best seen with an ordinary pocket lens.

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